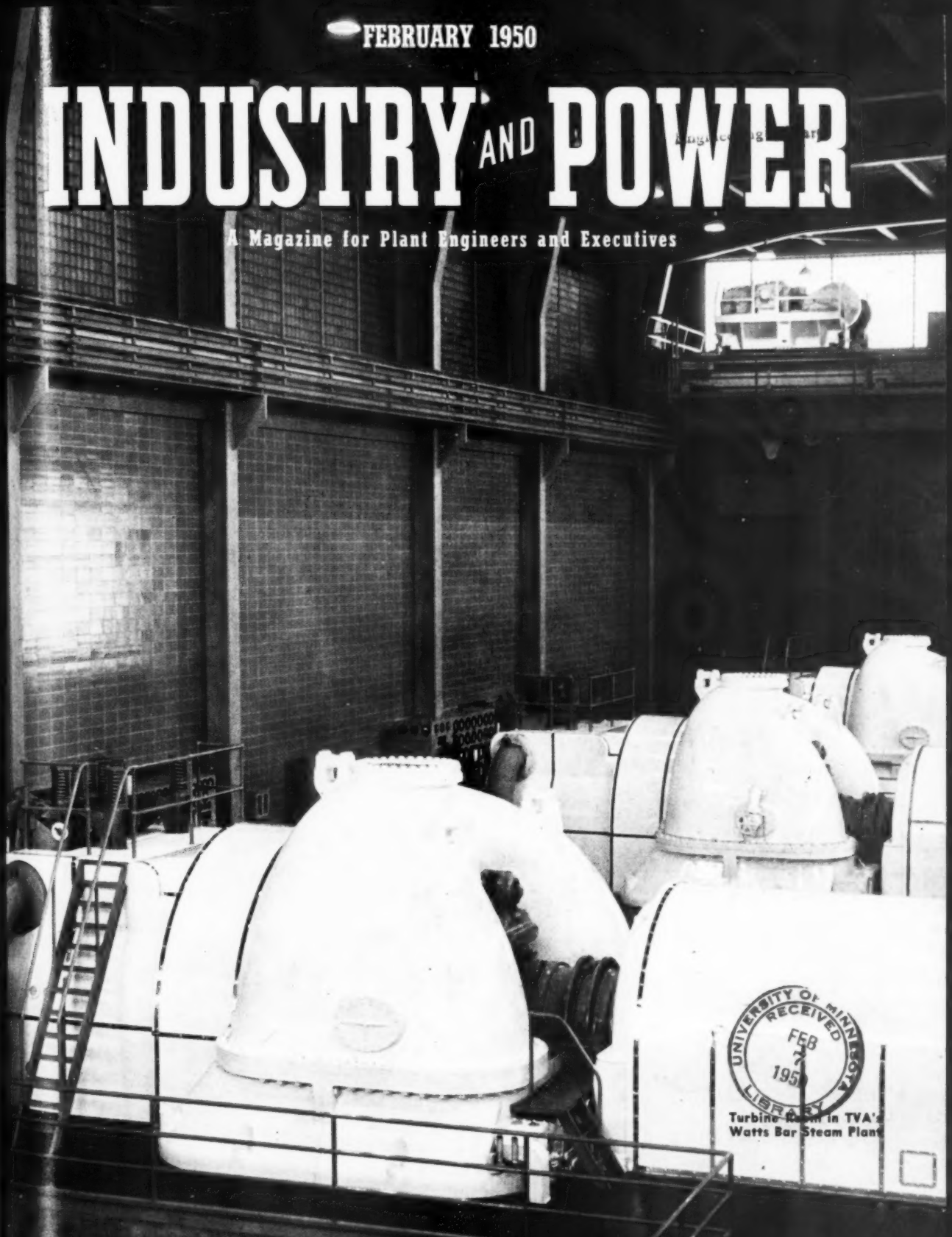
FEBRUARY 1950

INDUSTRY AND POWER

A Magazine for Plant Engineers and Executives



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Turbine Room in TVA's Watts Bar Steam Plant

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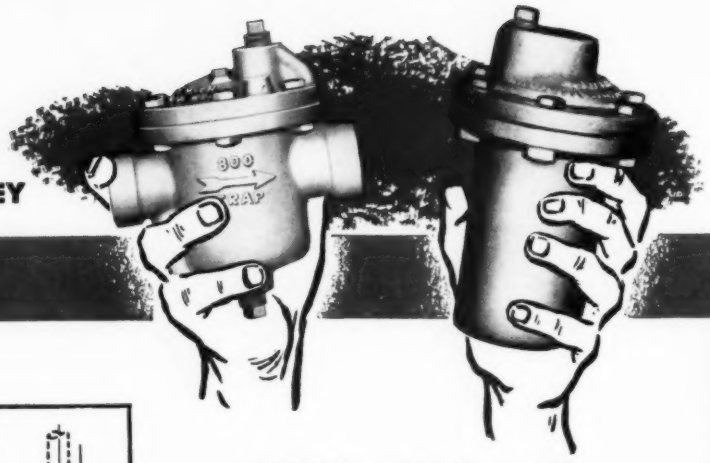
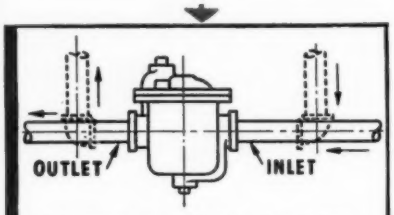
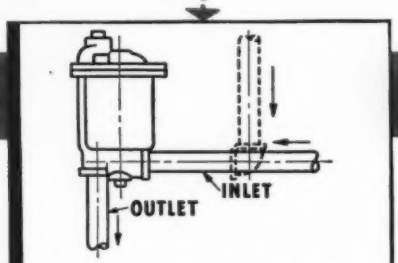
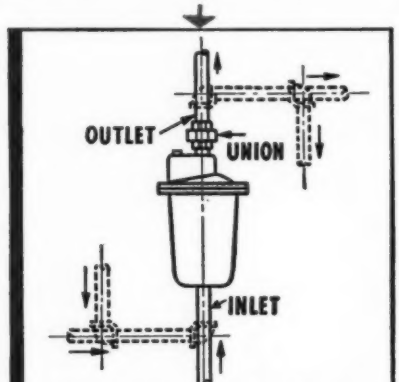




Connections for No. 800-813 side inlet-side outlet traps. Available in ½", ¾" and 1" sizes for pressures to 250 psi.



Side inlet-bottom outlet trap, ½" or ¾". Greatly simplifies connections to many types of small steam-consuming units.



Bottom inlet-top outlet body style. ½" through 2" connections. Cast semi-steel bodies for pressures to 250 psi. Forged steel bodies for pressures to 1500 psi.

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Cover Illustration

Attractive turbine room of the Tennessee Valley Authority's Watts Bar Steam Plant as seen from the visitor's balcony. Three of four General Electric 60,000 kw tubine-generators are shown. These units—which operate at 1800 rpm, 850 psi, 900°F—are of the horizontal, single-cylinder, impluse type, and employ 17 stages with 4 stage extraction. The 75-ton capacity crane, furnished by the Alliance Machine Company, is in the background. Industry and Power staff photograph through courtesy of Tennessee Valley Authority.

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Apropos of—

Invention Incentive

"NECESSITY is the mother of invention" said Richard Franck more than 250 years ago.

It still is true. And our necessities are on the increase.

For the first time since the beginning of the so-called Industrial Revolution (which is considered to have begun in the 17th century) invention seems to be lagging. In his excellent "James Clayton" Lecture given before the Institution of Mechanical Engineers in London on April 22, 1949 Mr. E. G. Bailey said: "There is evidence that greater impetus for invention is needed in the basic industries to maintain and advance further the present standards of living.

"Inventions of the basic type that instigated and propogated the Industrial Revolution are now waning. Many people feel that money spent on research alone is sufficient to meet all problems, but this is not necessarily the case, although it should, and can, be enough if selected personnel are trained with the understanding that research should foster invention, and not replace it." Thus it is evident that research is the big brother of invention but not its *alter ego*.

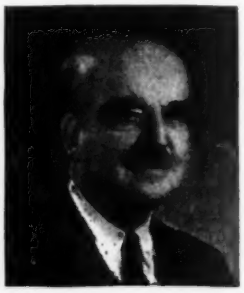
Well, how is one to invent? I guess, like a musician or a painter, one must be born that way. But, also like artists, one can improve one's skill by knowledge, study and practice.

The man of the inventive mind does one or both of two things: he builds on known facts and established inventions to more desired and more useful inventions, or he zooms off into the great unknown and comes back with a startling new, basic invention (this is most frequently done in the realm of chemistry, both organic and inorganic). These "pioneers" just fool around with things to see what will happen.

To quote Mr. Bailey further: "Inventions created industries. Industries required engineering and management. Engineering improved efficiency, thereby reducing the costs and labour required to supply man's needs and wants.

"We should now reverse the process which brought us to our present status and ask our engineers to concentrate on making industry as efficient as possible with the tools now available. Industry must plan and finance research to develop a more economic system, and research must lead to more worth-while inventions."

The incentives to invent, said Mr. Bailey, are "(a) The need for new products, processes, or services. (b) The need to produce a product, perform an operation or process, or render a service, either with less labour, or through the use of less, or more readily available material or equipment, or in less time, or at less cost. (c) The challenge to do something new for the gratification of accomplishment. (d) The desire to benefit mankind."



Then, of course, there is the material or financial reward. Mr. Bailey thinks, and I do too, that this factor is minor as man is by nature a creator.

Let's get busy and invent something—useful.

A. R. Mayer

Editor and Publisher

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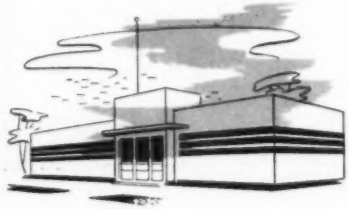

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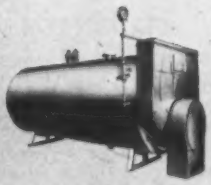
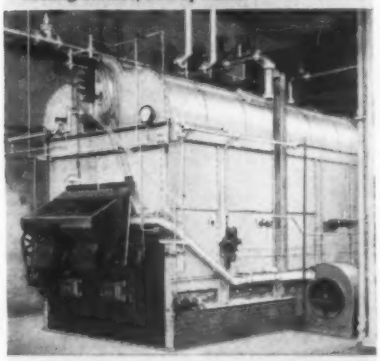
Titusville Scotch Marine High Pressure Boilers built with heating surfaces of 97 to 2993 square feet.

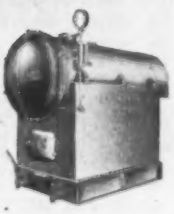
Titusville Scotch Marine Heating Boilers built in 19 sizes from 129 square feet to 2500 square feet heating surface, with 2190 to 42,500 square feet of steam radiation.



Titusville Ticotherm Steam Generators built in sizes ranging from 1000 square feet heating surface, and upwards.

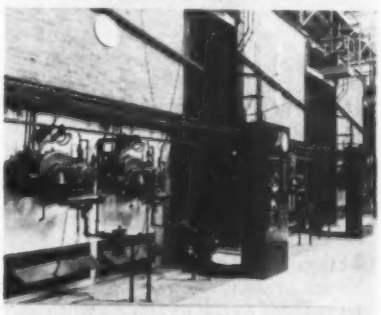


Titusville Portable High Pressure All-Welded Firebox-Firetube Boilers built in 13 sizes ranging from 250 square feet to 2500 square feet heating surface.



Three Pass Compact Type Welded Heating Boilers built in 19 sizes, from 129 to 2500 square feet heating surface, with 2190 to 42,500 square feet of steam radiation.

Titusville Bent Tube Water Tube Pressure Boilers built in sizes ranging from 729 square feet heating surface to 8316 square feet heating surface, in required pressures.



NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You Are Interested.

301—FILTERING ELEMENT IS FEATURE OF AIR CLEANER

Air cleaner which traps dust particles by means of an oil-wetted filtering element is now produced by the Donaldson Company, Inc. The new cleaner features a filtering element of uniform density woven from a single

strand of copper ribbon. The element is held in place under compression by a rigid screen, which in turn is retained in the body of the air cleaner by a snap ring. To service the cleaner, the operator simply squeezes the snap ring together and the whole element can then be taken out. After washing in solvent and re-oiling, the element is replaced and the snap ring reinserted.

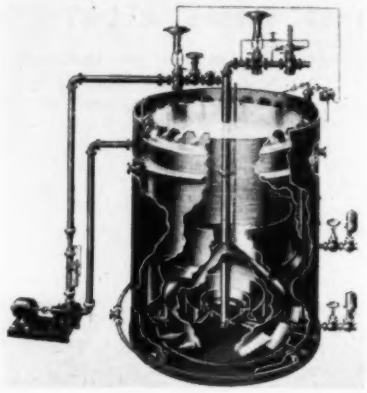
302—ABSORBER ELIMINATES SHOCK IN PIPE LINE

Complete line of compact liquid shock absorbers designed to eliminate shock and hammering in pipe lines and liquid systems is now available.

Leaky joints, opened pipe seams and excess pressure on valve packings can be reduced to the minimum when such damage is caused by the quick closing of valves or any action that suddenly stops the flow of liquid through a pump or other apparatus. There are no moving metal parts, and a rubber cushion, encased in a spherical metal chamber, absorbs the shock. This cushion pulsates constantly according to the increase or decrease of pressure in the system and can be installed in any position. R-S Products Corp.

303—WATER SOFTENER MIXED BY HYDRAULIC ENERGY

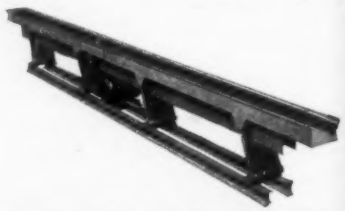
New cold process slurry type precipitating water softener and coagulator employs hydraulic energy for mixing the applied chemicals with previously formed precipitate. Complimentary recirculation of treated



water maintains a uniform depth of slurry bed independent of load demand. Where filters are used for final clarification, a washer reclamation compartment is incorporated to enable the filters to be economically backwashed with clean, chemically inert water without imposing increased flow rates thru the softener. Worthington Pump and Machinery Corp.

304—CONVEYOR HAS SYSTEM OF BALANCED FORCES

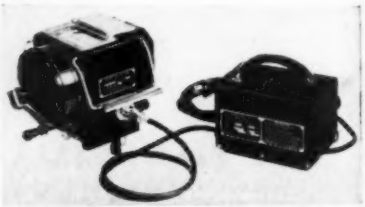
New conveyor operates on a system of balanced forces. It consists of a conveyor deck (pan or tube) mounted on cantilever spring bars, two beam supports, a counterweight also mounted on cantilever spring bars, and the drive. The weight of the conveyor deck and the counter-weight are balanced. The number and thickness of spring



bars are so related to these weights that the natural frequency of the machine is very close to the speed of the eccentric drive. Since the built-up restoring force of the cantilever bars is the basic drive force, the motor (driving the eccentric shaft) simply maintains the balanced forces and very little power is required to operate the conveyor. Up to 80 ft of the conveyor can be operated from one drive unit. The Jeffrey Manufacturing Co.

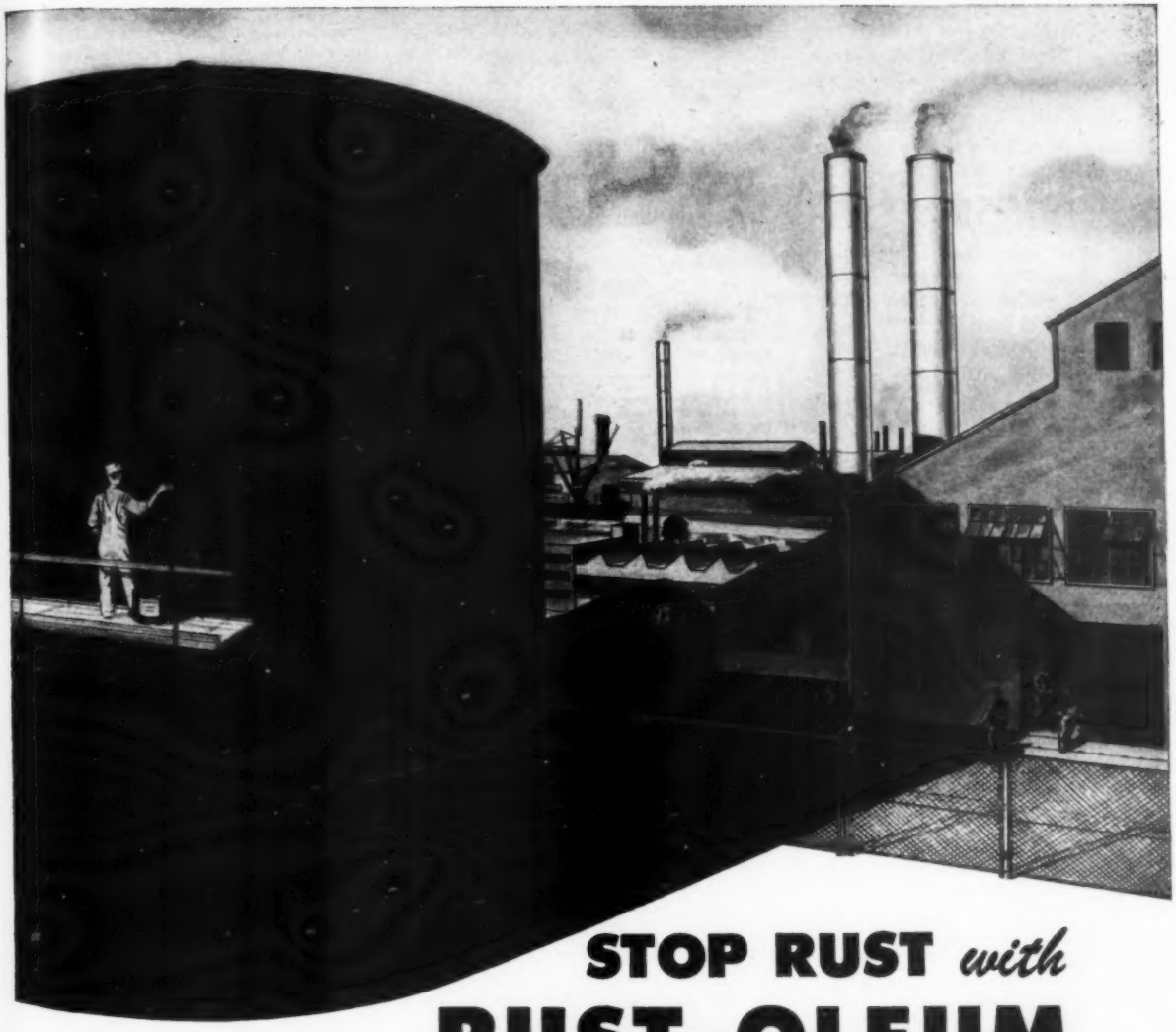
305—INSULATION TESTER CAN BE OPERATED TWO WAYS

A hand-cranked insulation tester is now available in a combination hand-crank and rectifier-operated set. The tester consists of the "meg" type constant-pressure test set and a separate



rectifier which supplies 500 volts d-c from any 115 volt a-c, 60 cycle outlet. One cord from the hand-crank instrument and another from the rectifier to an a-c outlet eliminates hand operation. This new dual-operated instru-

(Continued on page 10)



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** Names on request.*

RUST-OLEUM CORPORATION

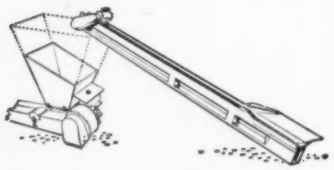
2472 Oakton Street, Evanston, Illinois

(Continued from page 8)

ment can be applied in communications and in extensive cable wiring and control installations where a great many tests are to be made, and where an a-c outlet is readily available. James G. Biddle Co.

306—CONVEYOR DEVELOPED TO FILL HOPPERS

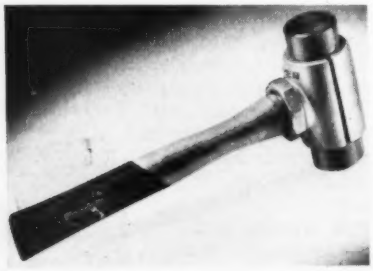
Conveyor suited for filling overhead hoppers on spreader stokers as well as underfeed hoppers where the capacity has been increased by extending the sides, is available. Considerable labor cost savings are effected



in the latter case by simplifying and minimizing the work of hopper filling and the extra hours of stoker operation without attention. The conveyor also can be used for trimming bins or as a flat conveyor. One model with a 4 in. belt and a 25 ton-per-hour capacity, weighs 135 lb in the 12 ft length and can be supplied with an undercarriage to facilitate moving if a portable installation is desired. Another model is recommended as a permanent installation where large tonnage is involved. Using an 8 in. belt, this model has a capacity of 60 tons per hour. Installation of either model is made by simply placing the conveyor in position and connecting to the nearest electrical outlet. New London Engineering Co.

307—REPLACEABLE FACES ARE FEATURE OF HAMMER

Four new design features, incorporated for increased work efficiency, have been introduced by Greene, Tweed & Co., in redesign of their line of replaceable face hammers—tools equipped for replacement and

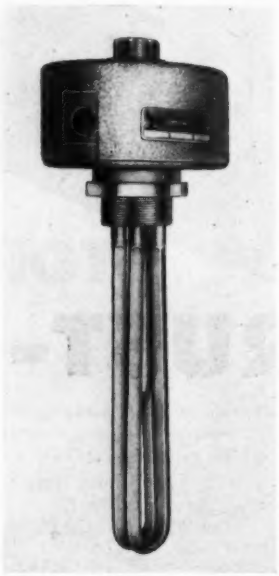


interchange of hammer faces. The faces are available in rawhide, Basa molded composition, plastic, copper, and babbitt, which offers the face that suit the work and prevents mar, chip, or "pile up" of material struck. Features include freer play between the jaws of the retaining head, which insures positive take-up and firm grip on the faces despite the slightest variation in the circumference of faces; shaping of the handle to fit the hand, for perfect balance to retard worker fatigue; lacquering of handle and enamelling of grip portion to preserve tool's cleanliness and neat appearance; and in addition, metal parts of the hammer are finished in a rust-inhibiting aluminum coating which has been baked on to give a hard wearing surface.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

308—IMMERSION HEATER HAS TEMPERATURE CONTROL

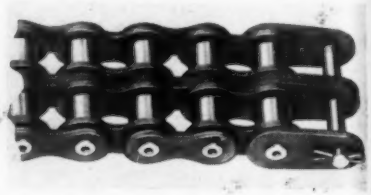
A new thermostatically controlled screw-plug immersion heater for heating chemical and oil solutions, and viscous and corrosive liquids has just been announced by the Edwin L. Wiegand Co. One-half inch diameter



hairpin tubular elements are welded or silver-soldered into a standard screw-plug for mounting in pipes and through the walls of tanks. Standard heaters are fabricated of either copper heating elements with a brass screw-plug, or steel elements with a steel screw-plug, depending upon the corrosive properties of the solution to be heated. The built-in thermostat has a temperature range of 60 to 250° F for heating water type solutions, or 200 to 550° F for oil and other viscous compounds. Temperature is controlled by an adjustment knob on the outside of the sheet-steel thermostat housing. The sensitive thermostat bulb is encased in a protective well mounted on the screw-plug and extending between the heating elements. Heaters are rated from 1.5 to 10 kilowatts for 115 and 230 v operation, single or 3 phase.

309—CHAIN CAN BE CONNECTED OR DISCONNECTED BY PIN

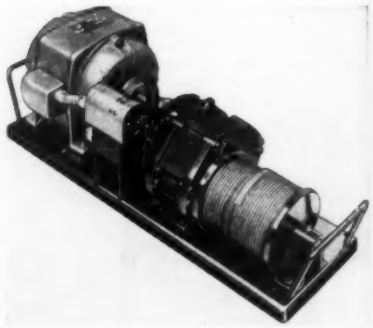
Designed to simplify disassembly and assembly of roller chain in the field or on the job is a revolutionary development in roller chain construction. Combined are the advantages (longer life and lower cost) of riveted chain with the advantages (ease of



disassembly and assembly) of cottered roller chain. The new assembly consists of a 5 ft basic length of standard riveted roller chain with a revolutionary new single pin connector assembled at approximately the 2 ft mark and at the end of the basic 5 ft length. The connecting link employs one detachable pin and one rivet. It is necessary to remove only one pin to disconnect the chain. There are no other loose parts, since the plates making up the connecting link all are securely press fitted to the remaining rivet. The new single pin connector has a distinctive tear-drop shape for identification. Chain Belt Company.

310—LIFT AND PULL POWER PROVIDED BY WINCH

St. Anthony Machine Products Company has announced a portable electric winch designed to provide mobile lifting and pulling power for material handling jobs in industrial plants and in the construction trades.



Available in a wide selection of models, the tugger is powered to furnish a line pull of from 500 lb to 1500 lb at speeds ranging from 55—220 ft a

(Continued on page 12)

A Nalco Representative checks over one of "his" plants with the plant engineer. Specialized training and experience make Nalco men your staff consultants on all water treating problems in your plant.

WATER TREATMENT SECURITY *for Your Plant with*

THE *Nalco* SYSTEM

WATER treatment security for your plant—as Nalco interprets it—means that aside from routine testing, control, and required inspections, you can stop worrying, *permanently* about steam purity, scale, corrosion, or other difficulties which might be caused by faulty water treatment procedures and chemicals. The Nalco System goes beyond a cursory survey and an order for chemicals. Your plant becomes the personal responsibility of your Nalco Representative; and he is backed by the entire facilities and personnel of the National Aluminate Corporation — nearly 600 skilled individuals who believe that effective industrial water treatment is up to Nalco standards only if each Nalco System plant is getting exactly the right treatment for the specific water, equipment and operating conditions involved. A postcard or letter will bring you further details on Nalco Water Treatment Security... Check on it today.

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem, Limited, Burlington, Ontario

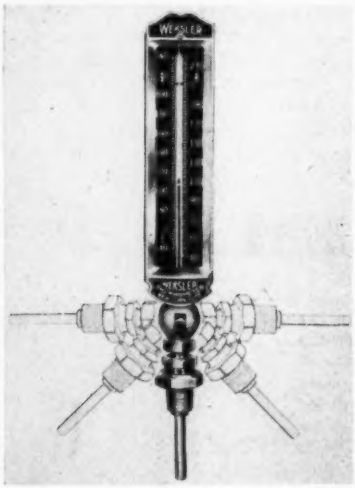
THE *Nalco* SYSTEM... Serving Industry through Practical Applied Science

(Continued from page 10)

min. Double reduction spur gears, specially fabricated from high tensile steel, convert the output of a high torque, repulsion-induction motor to a constant speed and power ratio on the drum of the winch. The reducer is coupled to the motor direct and is totally enclosed to permit higher gear efficiency and quiet operation while running in a continuous oil bath. A conveniently placed lever handle controls both the mechanical brake and the reversing switch on the motor.

311—THERMOMETER CAN BE SET FOR CLEAR READING

Feature of an industrial thermometer manufactured by Weksler Thermometer Corporation is the use of a flexible metal capillary within a specially designed ball connection which permits adjustments of the stem or case to any desired position for clear and easy reading. Any required angle . . . .front to back, left to right. . . thru



180° arc can be quickly made by a simple adjustment before or after installation. This instrument is supplied in three case sizes: 7, 9, and 12 in. with a two-piece bronze case and glass protecting bezel. The thermometer is available with union or separable socket connections in any standard size, and has been specially designed so that all union connections and separable sockets can be interchangeable. Supplied in standard ranges up to 750° Fahrenheit or equivalent Centigrade.

312—2,000 LB LIFT TRUCK HAS NEW ENGINE DESIGN

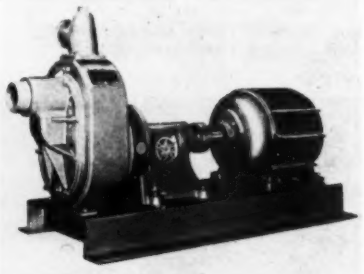
An entirely new 2,000 lb capacity lift truck manufactured by the Hyster Company operates at substantially lower running temperatures because of alterations in both design and installation of the engine. Changes in the engine are a new intake manifold; redesign of shrouds to pull cool, clean air from the sides of the machine rather than from top or bottom; a new electric fuel pump; and a new distributor. Engine accessory improvements include a larger automotive-type battery, a re-designed muffler with

spark arresting features; and a larger gasoline tank with more than sufficient capacity to permit full eight-hour work shifts without refilling. A new clutch, larger than before, provides smoother control. The transmission is now heavier, uprights, slightly lower in height, are now mounted on an extension of the truck frame rather than to the transmission case. Tilt control of the uprights is now accomplished through double-acting hydraulic cylinders for both directions of tilt. This permits a slower backward tilt, less sway of uprights, and the possible pushing of a load with the truck forks.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

313—PUMPS AVAILABLE FOR FLOODED SUCTIONS

Addition of a new line of straight centrifugal pumps has just been announced for use primarily on installations with flooded suctions and are offered in close- or long-coupled con-



struction, 1 to 4 in. sizes and with capacities from 10 to 1000 gpm. Consisting of casing, impeller with shaft sleeve and the driving motor, the units may be installed and operated in either vertical or horizontal position. The new centrifugal is said to embody advanced hydraulic principles. Features include an easily renewable sealing ring at the suction inlet and deep-groove oversize ball bearings sealed against dirt and moisture. The stuffing box, an integral part of the casing, is designed to contain a liberal number of packing rings. Marlow Pumps.

314—ELECTRIC CIRCUITS HAVE AUTOMATIC PROTECTION

Push-button switching and automatic protection for electric circuits is provided with new pushmatics. They are identical in size and contour, regardless of rating or type, and are easy to order and stock. Minimum supplies of basic electri-centers and an assortment of pushmatics are on hand and when an order is received, the installer is supplied with a basic electri-center from stock. Then pushmatics of the desired rating and type selected

can be assembled in the electri-center to meet exact needs. Electri-centers are available in assemblies of from 2 to 42 circuits. Pushmatics meet any load condition and are available in three distinct types: thermal, thermal-magnetic, or thermal-magnetic with ambient compensating feature. All are interchangeable for rating and type, in ratings of 15 to 50 amperes, 120 v, 1 pole, or 120-240 v, 2 poles, a-c. BullDog Electric Products Company.

315—AUTOMATIC DUCT HEATER CAN BE CONCEALED

Suspended or base-supported new automatic, concealed, gas-fired duct heaters can be applied to any type duct system, and can be used singly or in multiples. They are adaptable for

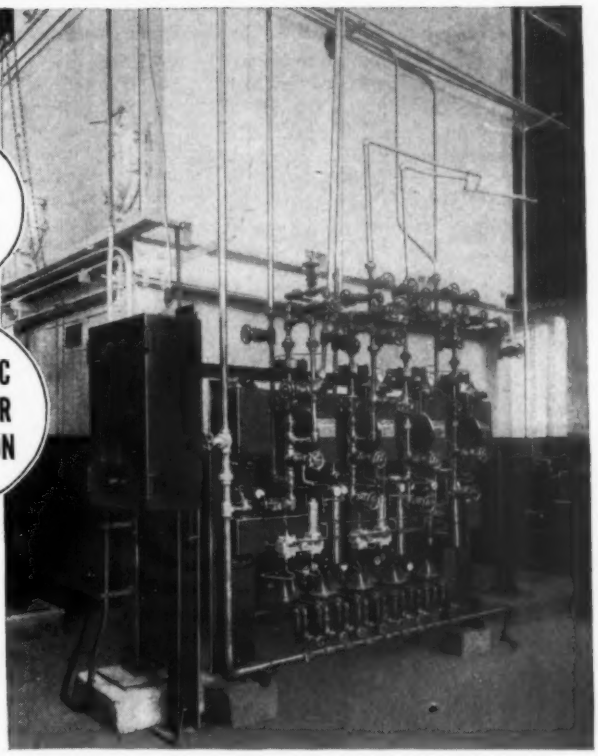
(Continued on page 14)

AUTOMATIC COMBUSTION CONTROL BY HAGAN

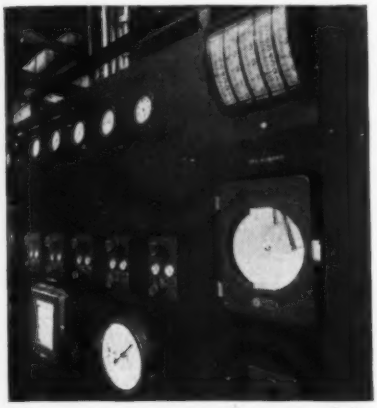
RING BALANCE METERS

AUTOMATIC FEEDWATER REGULATION

AT THE CLEVES, OHIO, REFINERY OF THE GULF REFINING COMPANY

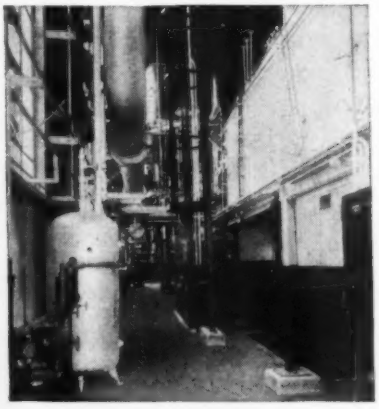


Components of the Hagan automatic feedwater regulation and combustion control systems are mounted at the side of each boiler, giving easy access for adjustment or servicing.



Separate instrument panels are provided for each boiler. Two Hagan Ring Balance Meters are mounted on each panel.

Below—*General view showing front of boilers and instrument panels in Gulf Refining Company refinery at Cleves, Ohio.*



Recent expansion of the refinery of Gulf Refining Company at Cleves, near Cincinnati, included the installation of two new boilers, each with a capacity of 70,000 pounds of steam per hour, and operating at 685 psi. Fuels used are refinery waste gas and oil, either singly, or in combination.

These new boilers are equipped with Hagan Automatic Combustion Control, Hagan Automatic Feedwater Regulation, and Hagan Ring Balance Meters.

The combustion control is a Hagan Differential Master system. With this system, waste gas is burned when available and is automatically supplemented or replaced by oil as necessary. Fuel feed is changed instantly to compensate for fluctuations in calorific value of fuel or changes in steam demand and excess air is automatically maintained in accordance with actual Btu. input.

Hagan Automatic Feedwater regulation is a multiple circuit system which proportions feedwater to steam flow and modifies feedwater flow in accordance with water level in the boiler. Thus the system not only holds water level accurately in a steady steaming state, but also "irons out" in an optimum pattern, the mutual disturbances existing between the steam generating circuits and the water flow circuits of the boiler in changing from one steam rate to another.

Two Hagan Ring Balance Meters are used with each boiler. One records steam flow, air flow and steam pressure; the other records feedwater flow and steam drum water level.

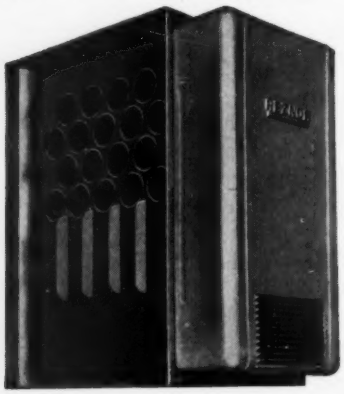
We will be glad to supply full information on Hagan Combustion Control, Hagan Automatic Feedwater Regulation and Hagan Ring Balance Meters. Write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

(Continued from page 12)

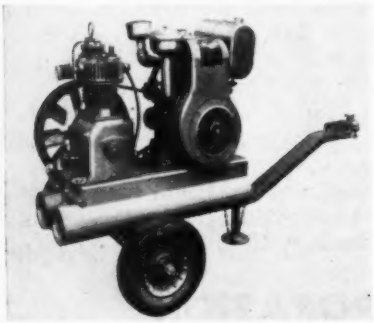
use with air conditioning units, and are designed for concealed installation along hot air routes. Direction of heat flow through the exchanger section is reversible, permitting alternate operations on different lines. Advantages claimed are: no bulky, internal storage facilities, all gas is burned within the combustion cham-



ber, then passed upward around special exchanger tubes, easy to clean (the entire burner chassis can be removed by simply loosening two bolts), also, there is an additional large clean-out opening located just under the draft diverter, correct and uniform gas pressure is automatically maintained at all times by adequate controls, and whenever the pilot light is not burning, gas cannot flow. A limit control that shuts off gas flow whenever the temperature exceeds a predetermined limit is standard equipment. Reznor Manufacturing Co.

316—AIR TOOLS OPERATED BY PORTABLE COMPRESSORS

Trailer-mounted portable compressor units have been developed by Gardner-Denver Company and are designed especially for operating small air tools on miscellaneous service jobs. Their capacity is ample for operating paint

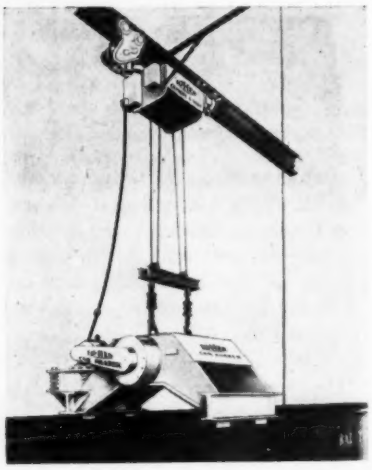


spray guns, chipping hammers, light paving breakers, spaders, tampers, and similar pneumatic equipment. The units are furnished complete with air-cooled compressor, V-belt drive to gasoline engine, and mounted on a sturdy pipe tank type base. Equipped with semi-pneumatic rubber tired roller bearing wheels, drawbar, trailer hitch, and stabilizer leg the unit can be towed behind a car or service truck. Three sizes are available, and all units are carefully balanced for one-man handling.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

317—SHAKER EMPTIES CARS IN MATTER OF MINUTES

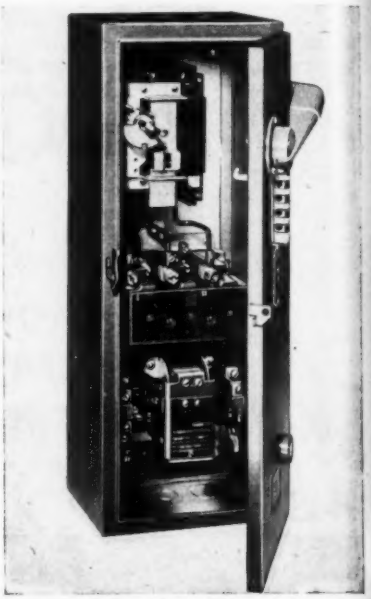
American Engineering Company announces the production of a new car shaker offered in combination with 5-ton, twin hook hoist and controls or with a single hook 5-ton hoist and controls. The shaker is available separately for use with existing hoisting equipment. Emptying cars can be done by one man in a matter of minutes and the shaker provides a fast, easy way to unload coal and other loose material from open hopper-bottom type cars. Double safety is



provided with interlocking controls and the hoist is equipped with a slack-line switch. The shaker cannot be operated until it is in position; conversely, the motor trolley cannot be started when the shaker is in operation. This double safety feature is available with all motorized trolley hoists furnished with this type car shaker combination. When a hand-geared trolley hoist or bolt suspension type is selected, interlocking trolley control is omitted.

318—COMBINATION STARTER FOR 1-100 HP MOTORS

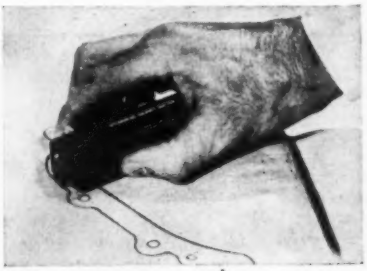
Square D Company has announced a new circuit breaker type combination starter which features both increased operator safety and simplified installation and maintenance. The starter is designed for control of polyphase motors, 1 to 100 hp. An interlock prevents opening door when breaker is "on", although an authorized person can release the interlock for inspection without power interruption. When the door is re-closed, a self aligning handle indicates true position of breaker. The



operating handle can be locked "on" or "off" with one, two, three, or four padlocks of varying sizes. The handle locking mechanism also locks the door. Straight-line, guided vertical motion of armature and movable contact assembly eliminates bearing and reduces wear.

319—INSTRUMENT CUTS PLIABLE SHEET MATERIAL

Disks, gaskets, and other similar cuttings down to one-quarter of an inch in diameter, straight strips of any length, and curves of any shape can be cut in pliable sheet materials with this versatile new gasket cutting instrument. From the molded body of lightweight bakelite phenolic material, a razor-sharp blade protrudes at



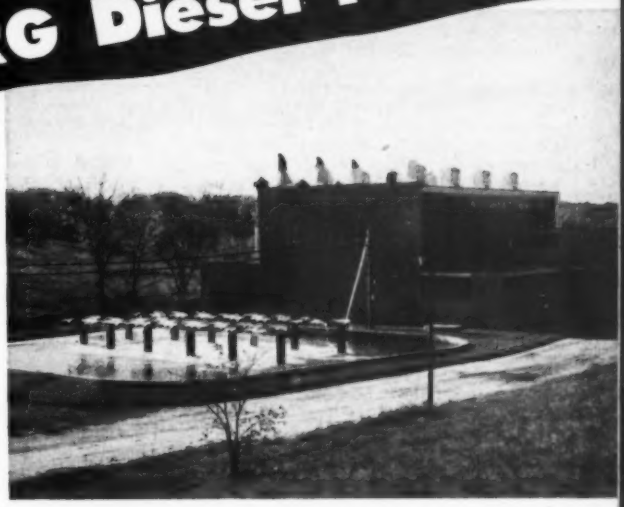
one end. To make a circular cut, the plastic slide block is set to the desired diameter, and the pivot post knob tightened to hold the block in place. The slide block is then set over a center pin stuck into the material and the

(Continued on page 138)

saving $150,000.00 annually with NORDBERG Diesel Power

THREE 3200 H. P. NORDBERG DIESELS SERVE MODERN PLANT AT PEABODY, MASS.

Here is another progressive municipality that has turned to Nordberg Diesels as the solution for its power problems. Since 1891 Peabody has maintained a steam generating station, but as is so often the case, this became outmoded with time and incapable of meeting today's demand for adequate power at low cost. The three Nordberg Diesel generating units now serving Peabody have ample capacity for the city's expanding electric service requirements, furthermore the plant will show a saving in excess of $150,000.00 a year — more than is necessary to liquidate the bonded indebtedness and take care of insurance, wages, maintenance and depreciation.



The new municipal power plant at Peabody, Mass., built a a cost of $1,218,000.00, is most modern in every detai The three big Nordberg Diesels in this plant develop total of 9600 H. P.

Nordberg Diesels are built in sizes up to 8500 H. P., i two and four-cycle types, including both oil and gas burnin models. Write for details covering a unit to meet you specific requirements.

NORDBERG MFG. CO., Milwaukee 7, Wisconsi

P250

NORDBERG DIESEL ENGINES

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Soot Blowers (A) Well-illustrated 16 page bulletin just released describes automatic-sequential power-operated soot blowing systems for all types and sizes of boilers. Complete operating procedures are discussed, and ten typical installations are shown diagrammatically. Vulcan Soot Blower Corp.

Bent Tube Boiler (B) Basic design features of this company's bent tube boilers are explained and illustrated in a new 18 page bulletin. Numerous cross-sectional drawings of boilers installed throughout the country are shown along with general operating conditions and specifications. Henry Vogt Machine Co., Inc.

Package Steam Generator (C) Illustrated 12 page bulletin contains data on several designs of packaged steam generating units. Sectional views are shown with outline dimensions and heating surfaces. Performance curves are indicated for oil fired, natural gas fired, and coal fired. Foster Wheeler Corporation.

Vacuum Pumps (D) This company has just released an informative treatise that covers an investigation of rotary vacuum pumps in power house application. Physical and performance characteristics of the pump, operating under actual field conditions, are given. Complete details of the test procedure and result are incorporated. Kinney Manufacturing Company.

Gas Burners (E) Four page folder contains operating data on six sizes of industrial gas burners and combination gas and oil burners. Specifications for each size burner is listed. A typical control diagram and suggested burner installation is shown. Iron Fireman Manufacturing Co.

Combustion Control (F) Three basic elements, which are contained in an automatic combustion control system, are clearly explained in an eight page bulletin just released. Photographs illustrate the many adaptations of the control to assure maximum combustion efficiency and minimum smoke. General Power Plant Corporation.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Stationary Engines (G) Diesel engines are described and numerous installations are illustrated in a new 20-page bulletin. Included are more than 100 specifications for engines ranging in power from the naturally aspirated, 6 cylinder, 175 hp engine with 8½ x 10½ in. bore and stroke, to a supercharged, 8 cylinder, 1500 hp engine with 14½ x 20 in. bore and stroke. Superior Engine Division of The National Supply Company.

Multi-Stage Turbine (H) Catalog contains a discussion of the economics of by-product power. Basic types of turbines for different operating conditions and applications up to 20,000 horsepower are listed. Several pages of photographs are devoted to design features and series of cut-a-way diagrams show various governing and control systems. DeLaval Steam Turbine Company.

Radial Diesels (I) Recent publication describes and illustrates a new two-cycle, 11 cylinder, 14 x 16 in. radial engine which develops 1800 hp at 400 rpm, or 1250 kw. Included in the illustrations are sectional views of the crankshaft and gear assembly plus a cross-section view of the engine that shows the pressure lubrication and piston cooling system. Nordberg Mfg. Company.

Diesel Engines (J) Two new bulletins contain complete specifications for six automotive and industrial model Diesels adaptable for highway and off-highway automotive applications, as well as a wide range of industrial and power units. Each bulletin includes general specifications; photographs of the various models; and drawings of torque horsepower, and fuel consumption curves. Cummins Engine Co.

WATER TREATMENT

Anti-Precipitating Agents (K) Technical folder describes the use of anti-precipitating agents for the prevention of scale, deposits, and corrosion in cooling systems, service water lines, heat exchangers, and other process equipment. A flow chart of a typical plant cycle is included to show where deposits may occur or where corrosion may take place. Corrective treatments are explained in detail. Power Chemicals Division, E. F. Drew & Co., Inc.

Water Hardness Test (L) Technical paper entitled "Total Hardness in Water by Direct Colorimetric Titration" explains thoroughly a quick and accurate method of testing water hardness by titration with an indicator—which is red in the presence of calcium and magnesium ions, and blue in their absence. Samples can be analyzed to 0.1 ppm in a range of 0.0—2.0 ppm. W. H. & L. D. Betz.

Cold Process Softener (M) Just released 16 page bulletin explains how this cold process slurry type precipitating water softener and coagulator operates. Each of the component parts—chemical mixer, softener and coagulator tank, and filter—are discussed and illustrated. A two page flow diagram illustrates method of installation sequence. Worthington Pump and Machinery Corporation.

ELECTRICAL EQUIPMENT

D-C Generators (N) Technical treatise contained in a recently issued bulletin describes the construction of d-c generators 150 kw or larger. Also included is a description of the "Frog-Leg" armature winding, a development of this company. The bulletin is well illustrated. Allis-Chalmers Manufacturing Company.

Capacitor Motors (N) Complete discussion on two types of single phase motors—capacitor-start and capacitor-start and run—is contained in a new 12 page bulletin. Construction features are illustrated, and specifications and characteristics are thoroughly explained. General Electric Co.

INSTRUMENTS, CONTROLS, RECORDERS

Oxygen Analyzers (P) Two attractive bulletins, which have just been released, cover the highly important and timely development of oxygen recorders and analyzers. Theory and principles of operation of newly announced equipment are completely explained, and numerous applications are given. Specifications are supplied for each of the analyzers and auxiliary equipment. Arnold O. Beckman, Inc.

Ring-Balance Flow Meter (Q) Illustrated bulletin explains how automatic compensation for pressure or temperature variations, or for both, are achieved in flow measurement of gases, liquids, and other fluids. Schematic

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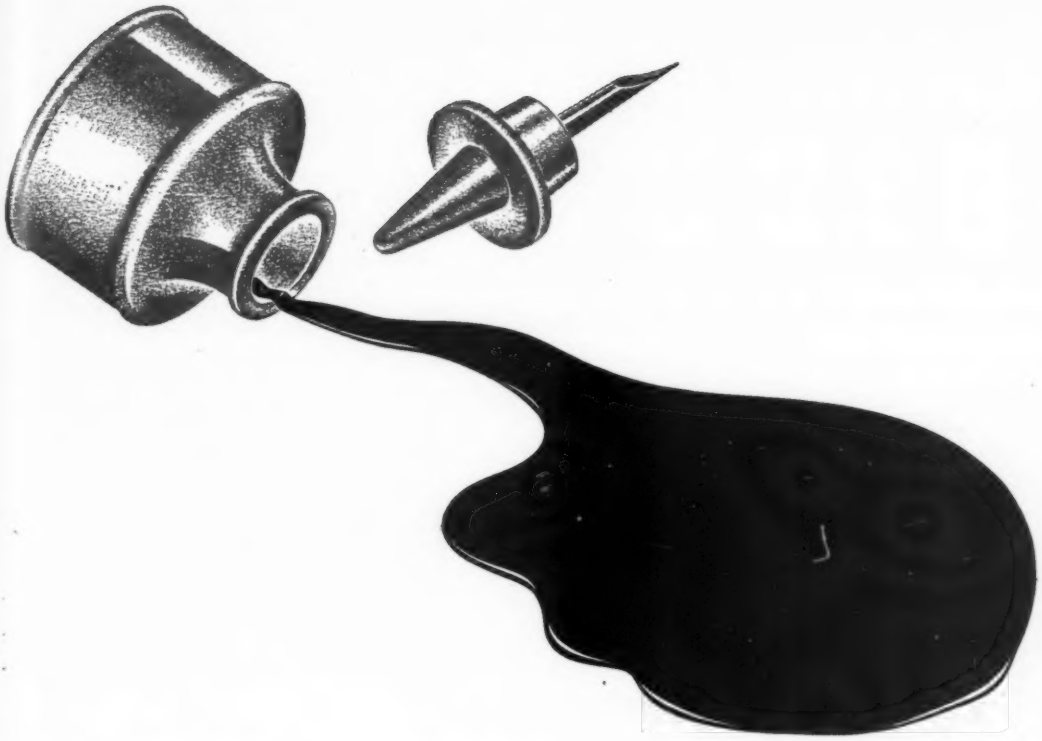


Here's the only "product" we make

And, it's a most important "product" for *your* business—black ink for your ledger! As a nationwide service organization of engineers and chemists specializing in the solution of all water problems, we offer a complete water conditioning service that is scientifically correct—designed to help you cut plant operating costs. If the results you are presently obtaining are not entirely satisfactory, let us explain more fully how our specialized service can benefit you.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa.
In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 109. Packaged Steam Generators: Send for fully illustrated Catalog 202 that gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

2—See page 175. Amesteam Generator: Dependable, quick steaming unit. Minimum installation expense, economical operation. Write for free Bulletin for full description and operational data. Ames Iron Works.

3—See page 177. Electric Boilers: Available bulletin supplies full data on units from ½ bhp to 15 bhp and for pressures up to 500 psi and temperatures up to 470° with 98% efficiency. Livingstone Engineering Co.

4—See page 137. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

5—See pages 54, 55. Complete Steam Generating Units: A Riley unit will reduce your investment costs by reducing building height, by eliminating costs of seals between unit and ash hopper, by eliminating cost of separate ash hopper, by reducing maintenance and increasing efficiency, and by lowering costs without sacrifice of operating advantages. Write for complete information. Riley Stoker Corp.

6—See page 153. Packaged Boilers with Horizontal Rotary Oil Burners: Bulletin 175 tells the complete story of this burner specially designed for firing in the elongated furnace of a packaged boiler. Bulletin 1000-E describes in detail other engineering features of steam generators. Get both bulletins. Preferred Utilities Mfg. Corp.

7—See page 149. "Economist" Boiler: Gas or oil—hand or stoker. Fully portable. No special foundation needed. High efficiency. Low Fuel Cost. Write for free catalog. The C. H. Dutton Company.

8—See page 70. Steam Generators: Send for your copy of the new Steam Generator Bulletin (SB-30) which illustrates and describes many types of super-heaters engineered and manufactured by Erie City Iron Works.

9—See page 7. All Welded Boilers: The Titusville Boiler Family includes all sizes of standardized heating and power all-welded firetube and water tube boilers. Write today for the complete series of new bulletins on TITUSVILLE boilers—the most complete, factual bulletins in the industry. The Titusville Iron Works Co., Div. of Struthers Wells Corp.

10—See page 147. Fan Stocks: Prat-Daniel offers an integrated induced draft system, combining the three elements of stack, breeching and I. D. fan, into one complete induced draft unit for highest efficiency. Write for the Prat-Daniel catalog on Fan Stacks. No obligation. Prat-Daniel Corp.

11—See pages 50, 51. Packaged Steam Generators: Write for your free copy of Bulletin PG-49-13b which contains drawings, sizes, and descriptions of Foster Wheeler Package Steam Generators. Foster Wheeler Corp.

BOILER FEED WATER

12—See page 17. Water Conditioning: Write for sound recommendations of Betz' engineers to help you select the water conditioning service best suited for your boiler plant. W. H. & L. D. Betz.

13—See page 6. Modern pH and Chlorine Control Book: New 96-page data-reference book describes scientific outfits and improved methods to step up boiler efficiency and prevent scale, corrosion, and embrittlement. W. A. Taylor and Co.

14—See page 160. Henszey Blowdown System: It will pay you dividends to learn how this system saves equipment, manpower and fuel. Write for the complete story. Henszey Co.

15—See page 59. Water Softeners: "Double-Check" line of softeners feature newly designed manifold and high-capacity zeolite. The "Double-Check" Method can also be applied to your present softener for dollar saving advantages and extra capacity. Write for more details. Elgin Softener Corp.

16—See page 155. Oxygen Corrosion Eliminator: Santosite, maintained in boiler feed water, removes dissolved oxygen and prevents oxygen corrosion. Send for Santosite Bulletin No. O-26. Organic Chemicals Div., Monsanto Chemical Co.

17—See page 146. Stop Corrosion in Your Steam Sysem: Designed expressly for use in steam systems. Coravol volatizes and condenses with the steam. Circulates throughout your entire steam system and protects all zones from corrosive attack. Write today for complete free data about the Coravol process. Western Chemical Company.

18—See page 11. Water Treatment Security: Check into the advantages that can be yours through the Nalco Service Agreement—complete water treatment survey, supervision of control and testing procedures, plus regular service calls. Your water treatment becomes the responsibility of Nalco. Write for full details. National Aluminate Corp.

19—See page 38B. Hot Process Softener: An interesting 66-page bulletin gives you a well-written explanation of the Cochrane Hot Process Softener together with complete descriptions of apparatus required and its application to many water conditioning problems. Write for your copy. No obligation. Cochrane Corporation.

20—See page 168. Scale and Corrosion Control: Write for your copy of "The Sand-Banum Story". This pocket-size booklet thoroughly explains colloidal control of scale and corrosion; gives you a simple, understandable description of application and how it works. Be sure to send for this booklet today. American Sand-Banum Co., Inc.

21—See page 53. Water Softeners: A new Graver Bulletin explaining the functions, principles and applications of Hot Process Softeners and the distinctive features of Graver designs is now available. Write for your copy today. Graver Water Conditioning Co.

22—See page 28. Free Laboratory Service: Send for Water Analysis Sheet. Fill it in and return with sample. Your laboratory analysis will be sent promptly. Valuable Infilco Chemical Calculator slide rule sent free to all who return analysis sheet properly completed. No cost or obligation. Infilco, Inc.

CLEANERS AND BLOWERS

23—See page 161. Portable Electric Blower: Protect motors and other equipment from burnouts and bearing failure by removng dangerous dust, dirt and lint. Write for Bulletin 579 for complete information on the TORNADO. Breuer Electric Mfg. Co.

24—See page 113. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

COMPRESSORS

25—See page 136. Motor Driven Compressors: Write for Bulletin 4910 which contains full details and operating data on Schramm's complete line of motor driven compressors. You're sure to find the right combination for your job. Schramm, Inc.

26—See page 131. Rotary Compressors: You get day in and day out continuous, uninterrupted service, with a minimum of attention and maintenance. Write for Bulletin C-5 on these life-time capacity machines. Fuller Company.

DIESEL POWER

27—See page 115. Muffler System: Fluor Series "D" Muffler System gives the highest muffling efficiency obtainable. Needs no redesign or alteration of existing plans for installation in new or old plants. Requires no more space than conventional mufflers. Submit your plans for recommendation and quotation today. No obligation. The Fluor Corp., Ltd.

28—See page 47. Superior Diesels: Be sure to read the remarkable success story on page 47 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated 20-page booklet, The National Supply Company.

29—See page 15. Nordberg Diesels: Three 3200 H.P. Nordberg Diesels are saving $150,000 annually for the new municipal power plant at Peabody, Mass. Savings like this are worth investigating. Write for details covering a unit to meet your specific requirements. Nordberg Mfg. Co.

DUST & FLY ASH COLLECTING EQUIPMENT

30—See page 119. Air Conditioning Equipment: Buffalo line covers every air handling and conditioning requirement. Write for information on best equipment for your plant. Buffalo Forge Company.

31—See page 57. Electrical Precipitator: Investigate to prove that the Aerotec Electrical Precipitator is far advanced in these four basic steps of precipitation: Charging the particle to collecting electrodes, Releasing the electrical charge, Deposition in storage hopper. Write for new literature now available on Aerotec equipment. The Thermix Corp., The Aerotec Corp.

32—See page 150. Dust Control: Write for information on how dust control equipment can create better working conditions that result in more production and lower costs. Dracco Corporation.

33—See page 141. Electrical Precipitation: Write for your free copy of an informative bulletin which presents full information on the Cottrell Precipitator. It effectively cleans stock gases by removing over 95% of all fly ash particles. Research Corporation.

34—See page 144. Dust Control Equipment: Roto-Clone helped a silverware manufacturer reclaim valuable silver dust result-

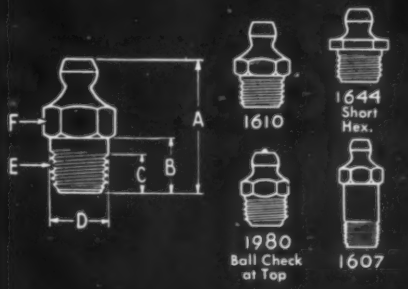
(Continued on page 20)

Genuine ALEMITE LUBRICATION FITTINGS

DATA SHEET
NO. 1

Simplify ORDERING, INSPECTION and INVENTORY CONTROL. Specify Alemite part numbers on your blueprints.

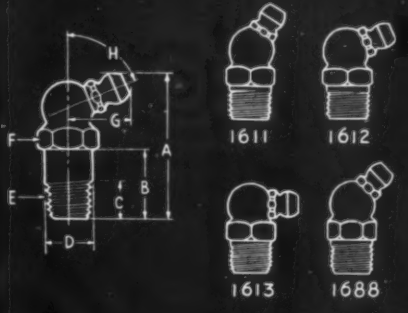
Useful Information to Help You Select and Specify the Right Alemite Fitting for Every Bearing



STRAIGHT HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F
1607	1 17/64"	25/32"	13/64"	13/32"	1/8" P.T.	7/16"
1610	3/4"	17/64"	1/4"	25/64"	1/8" P.T.	7/16"
1618	1 7/64"	5/16"		1/2"	1/4" P.T. (Female)	1/2"
1634	13/16"	5/16"	1/4"	13/32"	1/4" P.T.	7/16"
1644	21/32"	5/16"	1/4"	13/32"	1/4" P.T.	7/16"
*1650	57/64"	5/16"	19/64"	13/32"	1/8" N.P.T.F.	7/16"
1669	1 3/4"	1 17/64"	1/4"	13/32"	1/4" P.T.	7/16"
1684	2 5/8"	2 3/16"	5/16"	13/32"	1/4" P.T.	7/16"
*1708	53/64"	23/64"	19/64"	13/32"	1/8" N.P.T.F.	11/32"
1980	41/64"	17/64"	7/32"	13/32"	1/8" P.T.	7/16"

*Leak-proof seal
†Thread size listed as 1/8" P.T. is 1/4" P.T.F.—SAE EXTRA SHORT



1/8" THREAD ANGLE HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F	G	H
1606	1 13/16"	1"	3/8"	13/32"	1/8" P.T.	7/16"	15/32"	90°
1611	1 1/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	21/64"	30°
1612	53/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	1/2"	67 1/2°
1613	49/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	33/64"	85°
1614	1 5/64"	5/16"	1/4"	13/32"	1/8" P.T.	7/16"	31/64"	105°
1620	1 5/16"	13/32"	5/16"	7/16"	1/8" P.T. (Female)	7/16"	17/32"	45°
1623	1 3/16"	9/16"	1/4"	13/32"	1/8" P.T.	7/16"	21/64"	67 1/2°
1638	2 9/32"	1"	3/8"	13/32"	1/4" P.T.	7/16"	21/64"	30°
1649	2 25/32"	2 3/16"	5/16"	13/32"	1/4" P.T.	3/8"	29/64"	67 1/2°
*1651	1"	3/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	1/2"	67 1/2°
1688	61/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	27/64"	45°
*1692	1 7/32"	3/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	21/64"	30°
*1693	15/16"	3/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	21/64"	90°
*1950	1 1/8"	3/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	15/16"	105°

*Leak-proof seal. †Thread size listed as 1/8" P.T. is 1/8" P.T.F.—SAE EXTRA SHORT

1/4" PIPE THREAD HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F	G	H
1627	39/64"	23/64"	9/32"	17/32"	1/4" P.T.	9/32"	.....	.....
1629	1"	11/32"	9/32"	17/32"	1/4" P.T.	9/32"	5/16"	67 1/2°
1691	1 21/64"	Female Thread			1/4" P.T.	3/8"	.....	.....

†Thread size listed as 1/4" P.T. is 1/4" P.T.F.—SAE EXTRA SHORT.

1/4"—28 THREAD HYDRAULIC FITTINGS

Part No.	A	B	C	D	E	F	G	H
1636	31/32"	19/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	3/8"	3/8"	45°
1637	27/32"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	3/8"	3/8"	45°
1641	31/64"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1652	43/64"	23/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1680	59/64"	39/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1698	1 7/64"	31/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	17/64"	.....	.....
1703	1/2"	7/32"	3/16"	1/4"	1/4"-28 Taper USF-Thd.	17/64"	.....	.....
1770-A	19/32"	7/16"	7/64"	1/4"	1/4"-28 NF-2-Thd.	3/8"	25/64"	45°
1792	31/64"	9/64"	1/8"	1/4"	1/4"-28 NF-2-Thd.	17/64"	.....	.....
1911	47/64"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	3/8"	15/32"	90°

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Modern Lubrication Methods That Cut Production Costs

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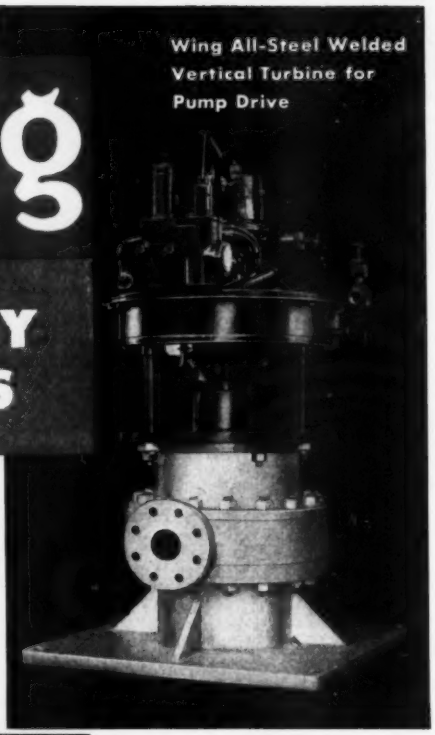
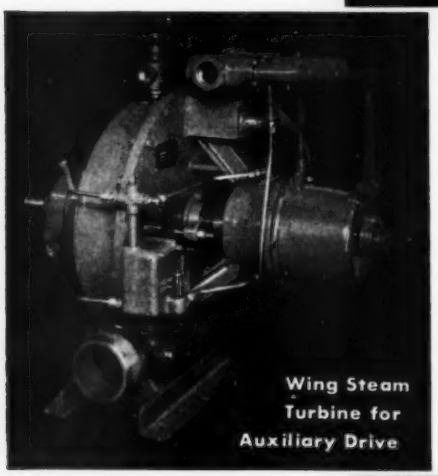
Wing

AUXILIARY TURBINES



Wing All-Steel Welded Vertical Turbine for Pump Drive

Rugged, compact, and dependable Wing Auxiliary Turbines are the most adequate and economical means of supplying power for many industrial and marine requirements. Their many advantages include low operating cost . . . . elimination of electric power . . . . lower maintenance costs . . . .and the fact that the oil-free exhaust steam resulting from their operation may be used for other purposes, such as heating, process work, etc.

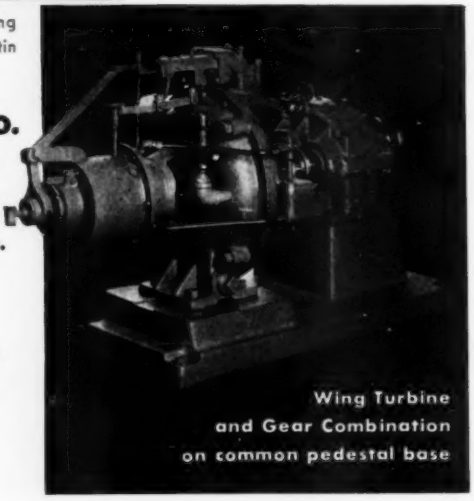


Wing Steam Turbine for Auxiliary Drive

In over fifty years of service Wing Auxiliary Turbines have amply proved their ability to stand up under the most rigorous service as prime movers for mixers, marine gear, pumps, fans, winches, generators, compressors, and other equipment. Their long record of consistently trouble-free performance has resulted in increasing acceptance of Wing Auxiliary Turbines as a source of power in many applications formerly using motor drive.

For further information on Wing Auxiliary Turbines write for Bulletin SW-48.

L. J. Wing Mfg. Co.
7th Ave. & 14th Street
New York 11, N. Y.
Factories:
Newark, N. J. • Montreal, Can.



Wing Turbine and Gear Combination on common pedestal base

READERS' GUIDE

(Continued from page 18)

ing from polishing and buffing sterling flatware. You too can receive profitable dividends in lower maintenance costs and better working conditions even if you collect dust to throw away. Get complete information on your own problems from American Air Filter Co., Inc.

35—See page 182. Electrical Precipitators: Bulletin C103 contains 28 pages of interesting charts, illustrations and descriptive data, and answers many of the questions engineers ask about Cottrell design and construction. Western Precipitation Corp.

ELECTRICAL EQUIPMENT

36—See page 128. 2 Speed and Reversing Controls: Ruggedly built for dependable action and long, maintenance-free service. There's a size and type for every purpose and with a wide range of ratings. Write today for literature describing these controls in detail. Arrow-Hart & Hegeman Electric Co.

37—See page 145. Prefabricated LTG Flex-A-Power: Rated 50 amps—250v, AC or DC. Supplies power for fluorescent lights and power tools. The only unusually rugged plug-in or trolley busway in 2, 3 or 4 pole construction in one compact housing. For more information, write for Circular TEC-3. The Trumbull Electric Manufacturing Co.

38—See page 171. Voltage Regulators: Write today for full details on Stabiline Electromechanical Voltage Regulators. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings: capacities to 100 KVA. The Superior Electric Co.

39—See page 166. Fuses and Clamps: It will pay you to write for the facts about this Trico production booster combination. "Kliplok" clamps eliminate damage to electrical equipment and unnecessary shutdowns. "Powder-Packed" renewable fuses provide temper-proof protection. Trico Fuse Mfg. Co.

FLOOR REPAIRS

40—See page 160. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or completely overlay. Used indoors or out. Dries fast. Send for free trial offer and complete information. No obligation. Flexrock Company.

FUELS AND FIRING EQUIPMENT

41—See pages 42, 43. RotoGrate Stokers: Investigate the RotoGrate—the original spreader stoker with forward moving grates that slowly and continuously discharge the ash at the front. Fully automatic. Write for more details. Detroit Stoker Company.

42—See page 124. Stoker-Veyor: Ask for Bulletin 916. Completely describes Stoker-Veyor—speeds filling of hopper and removal of ashes. American Conveyor Co.

43—See page 177. Fuel Oil Additive: Houghto-Solv is Houghton's proven additive for treatment of fuel oil systems to remove sludge by taking it into solution and actually making it burnable. Costs only a tiny fraction of a cent per gallon of fuel oil. Write for complete, valuable data. E. F. Houghton & Co.

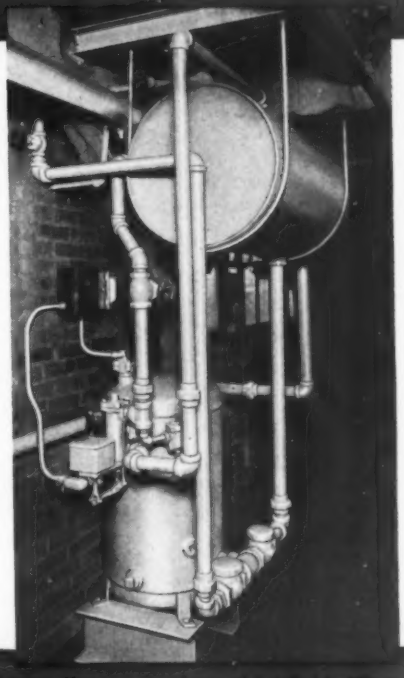
44—See page 125. Coal for Industrial Use: Choose from these three industrial coals—Old Abe, Skibo, Vogue—any one of which will give you a new high in efficiency at low cost. Write for complete information or assistance of skilled combustion engineers. Southern Coal Company, Inc.

45—See page 180. Fuel Oil Additive: Write for full details on Nalco SR-155—a single liquid compound that promotes more complete combustion, eliminates smoke, removes soot, prevents sludge, and inhibits corrosion. National Aluminate Corp.

46—See page 156. New Automatic Oil Burner: Wide-range oil-burning system assembled complete on one base for all types of boilers and furnaces from 100 developed hp and up. Write for your copy of new Bulletin 400 for full details and specifications. Peabody Engineering Corp.

(Continued on page 24)

BIG SAVINGS IN HANDLING CONDENSATE FROM HIGH PRESSURE PROCESSING EQUIPMENT



Pictured at right is another example of how the Johnson Electrap can be utilized to end many of the heat losses and limitations of the conventional pump and receiver unit usually used to return condensate from high pressure processing equipment back to boiler room.

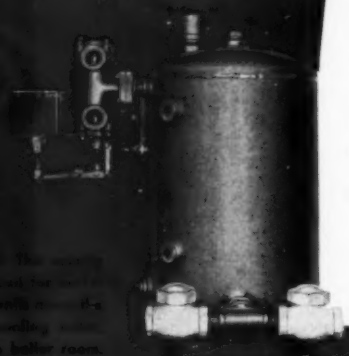
As a general rule the ordinary pump unit cannot handle condensate hotter than 180°. Consequently pressure and temperature of condensate must first be reduced, and valuable heat units deliberately dissipated. On the other hand, the pumping system engineered around the Electrap returns condensate with all heat units still intact—eliminates the losses that come with the unrestricted flashing of condensate and the addition of cooling water. In many cases, this can mean direct power and fuel savings of 10% and more.

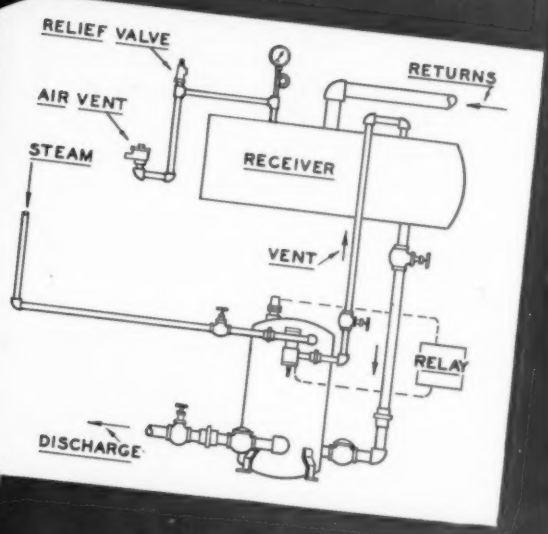
New Data Book has complete engineering information on high temperature condensate drainage with the Johnson Electrap; write for your copy today.

Eliminate these Losses

No. 803 Johnson Electrap, one of several installed in Hilton-Davis Chemical Co., Cincinnati, Ohio. Returns condensate from dye manufacturing and process equipment operating at pressures from 30 to 125 lbs. Uses 150 lb. steam pressure, operates against 70 lb. back pressure, returns condensate to boiler room at a minimum of 250°.

The Johnson *ELECTRAP* for Pumping Service





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DIRECT OPERATED CONTROL VALVES — STEAM WATER HEATERS

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Industry's *new* steam drive

Here's the new general-purpose turbine that meets the increasingly rigid demands of modern industry. Wrapped up in one *standard* unit are the best features of previous Westinghouse drives . . . plus important refinements and new developments, including features formerly obtainable only as costly "specials".

The new "Type E" is designed to operate reliably and efficiently where the going is tough. It's built to give trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a standby drive . . . regardless of operating conditions.

Weatherproof bearing seals, corrosion-resisting gland zones, centerline support for freedom of expansion and contraction, dual protection against overspeed, floating movement of governing and trip linkages, and parts interchangeability between wheel sizes are among the many advantages built into the new Type E drives.

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Westinghouse TYPE E Turbines

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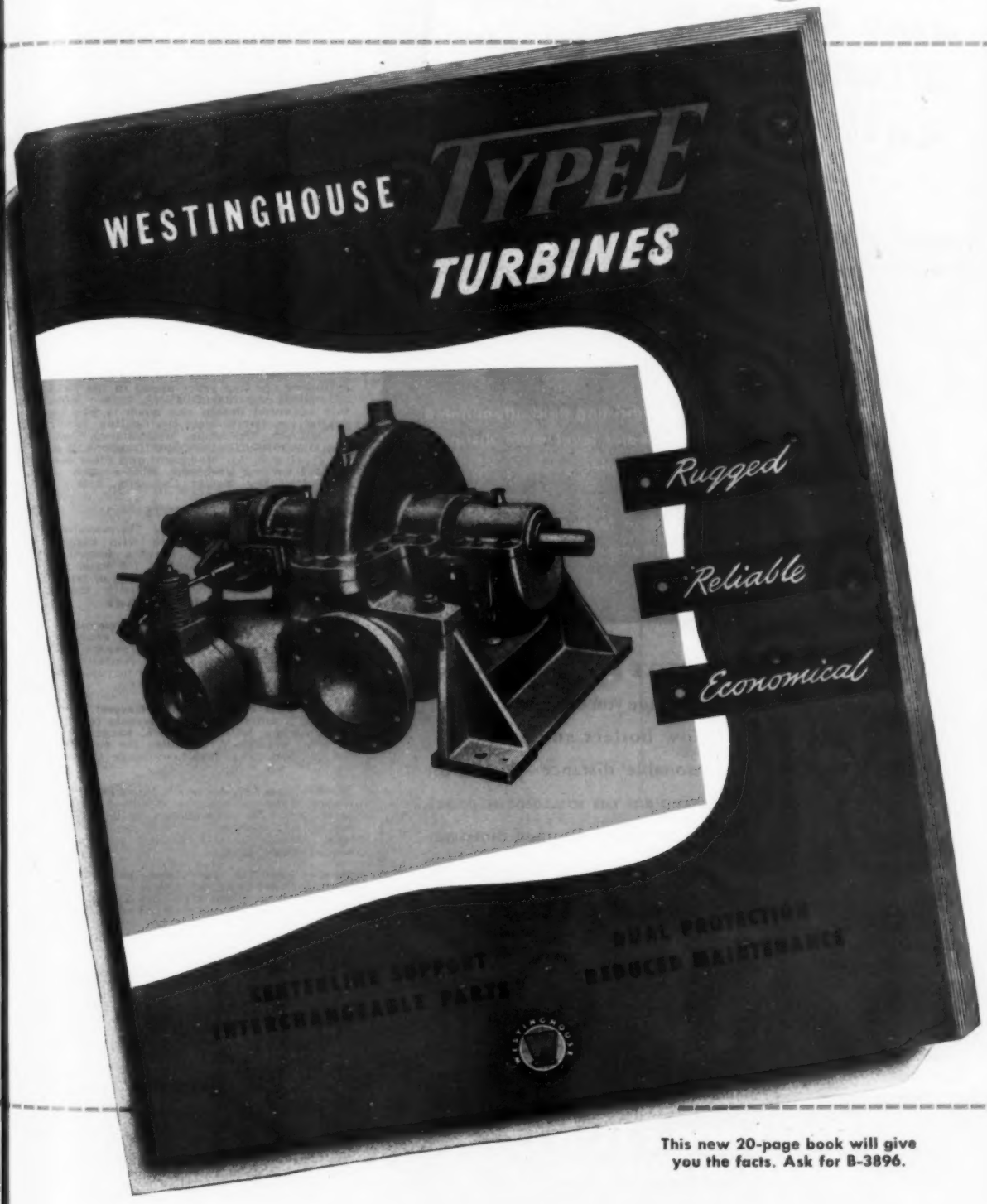

This new 20-page book will give you the facts. Ask for B-3896.

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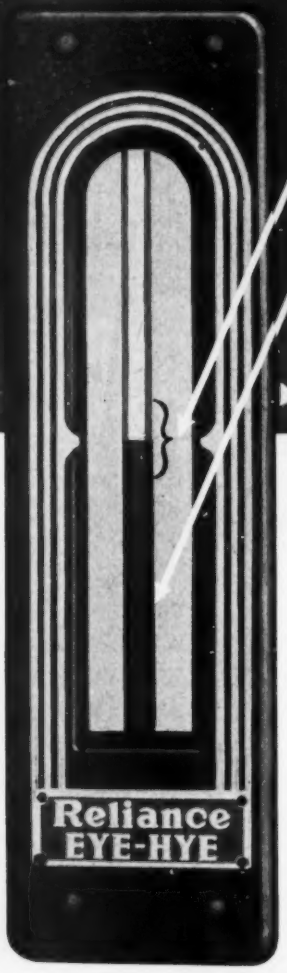
READ BOILER WATER LEVELS accurately, quickly with Reliance EYE-HYE®

Remote Reading Liquid Level Gage



Sharp contrast between steam and water indication.

Green indicating fluid, illuminated, shows water level more distinctly than the boiler gage.

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EYE-HYE is a simple, all-hydrostatic gage you can place above or below boilers and tanks—any reasonable distance—mount the instrument on instrument panel, wall or girder. Rugged construction; no mechanical working parts; easy to install; practically no maintenance. Write today for EYE-HYE literature.

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Remote Reading Gage

All-hydrostatic • Reads like a tubular glass gage

READERS' GUIDE

(Continued from page 20)

HEATING, VENTILATING AND AIR CONDITIONING

47—See page 105. Tankless Water Heaters: Provide independent hot water supply for washrooms or process units. No tank to install. Use as booster to your present tank-type system. Available in 12 sizes up to 270 gpm. Write for Catalog 18. General Fittings Co.

48—See page 45. Dust & Fume Control Systems: Write for any of the following booklets: "Dust Collecting Systems in Metal Industries", "Blower Systems for Woodworking Plants", "Fan Systems for Various Industries". Please indicate booklets you want. Kirk and Blum Mfg. Co.

49—See page 169. Air Conditioning: Niagara "Controlled Humidity Method" gives complete control of temperature and relative humidity. Provides dry air at normal atmospheric temperatures with little or no refrigeration. Read this informative advertisement then write for additional data. Niagara Blower Co.

50—See page 167. Peabody Air Heater: Bulletin 600, beautifully printed in full color, will show you exactly why there are so many satisfied users of Peabody Direct Fired Air Heaters. Send for your copy today. Peabody Engineering Corp.

HEAT EXCHANGERS

51—See page 32. Cooling Equipment: Marley fans, geareducers, drive shafts and fan cylinders are five years ahead in the field of cooling equipment. Check to see what this advanced design can mean to you by asking for free folders on Cooling Tower or DriCooler Operation, Maintenance, Testing, Water Distribution, Specifications, Water Treatment, Air Movement and other important cooling problems. Mail coupon in ad today. The Marley Company, Inc.

INSTRUMENTS

52—See page 152. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications—wide variety of types. Write for Thermometer Bulletin today. Weston Electrical Instrument Corp.

53—See page 173. Industrial Thermometers: Send for Catalog that describes complete line with a wide selection of ranges and sizes. Prompt repair service available on all makes of thermometers and thermostats. The Philadelphia Thermometer Co.

54—See page 24. Water Level Gauges: These EYE-HYE units solve your remote reading problems for boilers, heaters, surge tanks or other vessels. Write today for complete information. The Reliance Gauge Column Co.

55—See page 160. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

56—See page 138. Combustion Control: Publication 47-605 is exceedingly helpful in improving steam plant efficiency and reducing fuel costs. It contains many descriptions of how other plants are solving their combustion control problems. The Hays Corporation.

57—See page 60. Smoke Density Recorder: Detects smoke density by a Bolometer which is not harmed by high ambient temperatures. For complete information on how you can profitably use this unique instrument to erase your smoke troubles, ask for Bulletin 211. Bailey Meter Company.

58—See page 181. Flue Gas Analyzers: Free booklet shows how to get quick dependable check on CO_2 content of flue gases with accuracy within 3/10 of 1%. The Permutit Company.

59—See page 176. Chrono Telemeter: Records and transmits flow information—paces chemical proportioning pumps feeding boiler water chemicals. Request bulletins and complete information on this double-duty system today. Builders-Providence, Inc.

(Continued on page 26)

IS YOUR SLIPPAGE SHOWING?

..Important question for users of reciprocating pumps and air or hydraulic cylinder mechanisms

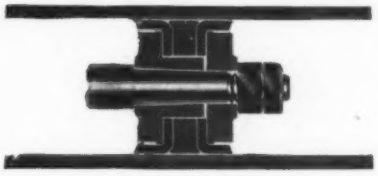
ILLUSTRATIONS at right show how Darcova Pumcups, in contrast to ordinary piston packing, virtually eliminate fluid slippage for the entire life of the packing. And, Pumcup life is many times that of ordinary packing.

By holding slippage to an absolute minimum, Pumcups permit reduced operating speeds, maintain high volumetric efficiency, prolong equipment life, save power, prevent wire-draw and uneven cylinder wear, and eliminate the need for frequent replacement shutdowns.

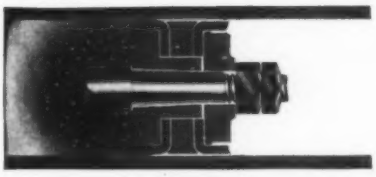
So if slippage is showing up in your operating and maintenance records . . . if replacement of packing is a too-frequent chore, that's your cue to switch to Darcova Pumcups.

For a free bulletin containing complete information, write, or use the coupon below.

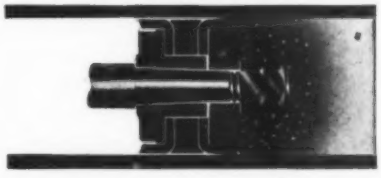
DIAGRAM OF PUMCUP ACTION GREATLY EXAGGERATED



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



Darcova Pumcups replace ordinary packing in reciprocating pumps and also in air or hydraulic control mechanisms. They are precision built of an exclusive, exceptionally durable composition material available in many textures for use with almost any fluid under a wide range of pressures and temperatures. Standard sizes range from ½ to 42 inches in diameter.

DARCOVA

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 9, Pa.
Please send me the free bulletin checked below:
☐ No. 4401... Darcova Pumcups for reciprocating pumps.
☐ No. 4502... Darcova Pumcups for air or hydraulic mechanisms.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

READERS' GUIDE ... CONTINUED ...

(Continued from page 24)

60—See page 164. Ernstlit Adjustable Inclined Column: Send for Bulletin T-1 which contains specifications of the Ernstlit adjustable inclined column, specially designed for package type boilers up to 300 Pounds W.S.P. Full information, too, on Leakless Try Cocks. Write today. Ernst Water Column & Gage Co.

INSULATION

61—See page 61. Kaylo Insulating Material: Available in block or pipe covering form, this material is remarkably efficient throughout a wide 200°—1200° F. temperature range. Send for your free samples and descriptive literature. Kaylo Division, Owens-Illinois Glass Co.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

62—See page 170. Lubricants: Ask for your free copy of the Albany Recommendation Chart. It's helpful and informative. Adam Cook's Sons, Inc.

63—See page 132. Absorbent Oil Filters: Carefully controlled tests under operating conditions show that Nugent filters get 99.8% of the dirt. That means longer life and less maintenance for your equipment and real savings in oil. There's a proper size and type for your requirements. Write for complete data. Wm. W. Nugent & Co.

64—See page 33. Lubriplate Lubricants: Ask for facts and figures on the variety of oils and greases developed to give protective lubrication to your machinery even under conditions of moisture and acids. Fiske Brothers Refining Co.

65—See page 179. Lubricating Oil Purifiers: The Hilco line of purifiers, reclaimers and filters offers complete recovery service for all types of lubricating and industrial oils. Write for free literature. The Hilliard Corp.

66—See pages 110, 111. Lubricants: Greases and oils "job proved" to stand up under heavy-duty operation. Learn how you can keep your equipment operating steadily and safely, with minimum time-out for maintenance. Write for full information. Sun Oil Co.

67—See page 179. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

68—See pages 116, 117. Sinclair Rubilene Oils: Rubilene resists oxidation; retards the formation of damaging acidic compounds, gum and sludge; is non-foaming. Additional information on request. Sinclair Refining Co.

69—See page 19. Alemite Lubrication Fittings: FREE. Complete set of four Data Sheets, similar to the one shown on page—, giving specifications on all types and sizes of Alemite Lubrication Fittings. Yours for the asking. Alemite Corp.

70—See page 35. Lubrication Service: You'll find Standard Oil Co. (Indiana) important to you because you get faster deliveries on every lubricant and fuel necessary to the efficient operation of your plant. Also take advantage of their On-The-Spot Engineering Service. Write for full information on this service. Standard Oil Company (Indiana).

71—See page 118. Gits Oilers: Write for free booklet describing in detail the full Gits line of the most modern oilers and lubricating systems. Also, yours for the asking, free lubrication engineering service without obligation. Investigate. Gits Bros. Mfg. Company.

72—See page 141. Non-Fluid Oil: Send for Bulletin No. 504 and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

MAINTENANCE

73—See page 178. Complete Service for Elevated Water Tanks: 30 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication. "Sound Principles of Water Tank Maintenance and Tank Talk" Dixie Tank and Bridge Co.

74—See page 9. Rust Prevention: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corp.

75—See page 177. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 diagrams. Send today for your copy. Smooth-On Mfg. Co.

76—See page 164. Joint Sealing Compound: Write for more details and cost of Key-Tite, the perfect seal on all lines carrying water, gas, low-pressure steam, compressed air. Joints can be easily opened. Does not effect taste or odor of potable liquids. Key Co.

77—See page 154. New, Free Handbook: Write for your copy of "Commutator and Slip Ring Maintenance". Contains authoritative information on commutator and slip ring maintenance. Fully illustrated. Forty pages of facts. Ideal Industries, Inc.

78—See page 149. Stop Corrosion with Metallizing: Free for the asking, Bulletin 62 pictures many different types of metallizing jobs and shows you how to stop corrosion. Also see how the same Metco gun can be used to spray many metals for repairing worn machine parts and save yu 90% of replacement cost. Metallizing Engineering Co., Inc.

79—See page 127. Valve and Bibb Reseater: Don't junk expensive globe and angle valves, bibbs, fixtures—reseat them with the Skinner Valve and Bibb Reseater. Easy to use. Pays for itself on first 2 or 3 jobs. Write for more information or order from M. B. Skinner Co.

80—See page 36. Rust Preventive: Check with the Standard Oil Lubrication Specialist near you for advice on such products as Stanorust 1-XC, a rust preventive especially developed for severe outdoor service. Or write to Standard Oil Company (Indiana).

MATERIAL HANDLING

81—See page 137. Shock-Pad Conveyor Belting: Designed for conveying heavy abrasive material, this belting has built-in pads of thick, specially compounded shock-absorbing rubber. Write for full information. Hewitt-Rubber Division, Hewitt-Robins Incorporated.

82—See page 142. Lift Trucks: It will pay you to investigate ROSS Lift Trucks (capacities 5,000 to 18,000 lbs.) for your plant. Find out how they can become vital links in your materials-handling system. Full details on complete line will be sent without obligation. The Ross Carrier Co.

83—See page 126. New Towmotor Sound Movie: "The One-Man-Gang" is packed with materials handling ideas for management and operating groups. Ask to see it in your plant. No obligation. Towmotor Corporation.

84—See page 103. Lift Trucks: Use the same truck inside your plant or outside in your storage yard—the Hyster "20". Greater maneuverability—increased traction. Write for free literature. Hyster Company.

85—See page 172. Jib Cranes: Send for complete description of industrial pillar type jib cranes designed to rotate 360° and built in capacities to 6 tons. Industrial Equipment Co.

86—See page 166. Anti-Friction Gates: Made in sizes from 14 to 30 inches these gates require no maintenance other than periodic greasing. Complete information on request. Beaumont Birch Company.

87—See page 114. Diesel Electric Locomotives: Porter engineers will be glad to survey your switching requirements and submit specifications for a standard or, if necessary, a special unit designed to your individual requirements. A porter engineer can show you how to cut your switching costs. H. K. Porter Company, Inc.

88—See page 4. Coal Handling System: Take a look at the integrated coal handling system designed for New York State Electric & Gas Corp. by Link-Belt. You'll find this advertisement on page 4. You can obtain equal efficiency and economy of operation by checking with Link-Belt's nearest office. Link-Belt Company.

89—See page 159. Electric Vibrators: If you have a troublesome bin or hopper write the details to Syntron. Their Engineering Department will be glad to give you their recommendations without obligation. Syntron Co.

PACKINGS AND GASKETS

90—See page 130. Packings: Send for Belmont Catalog No. 40 which reduces packing facts down to the simplest forms. You'll find a packing shown for every service. The Belmont Packing & Rubber Co.

91—See page 120. Durametallic Packings: It will pay you in many ways to use this custom-built packing. Your first step is to send for File No. DMIP covering Durametallic and Dura Plastic Packings. Durametallic Corporation.

92—See page 25. Piston Packing: Pumcups offer two advantages that often mean a saving up to $100 per pump per year. First, downtime and material and maintenance costs are cut because Pumcups last longer. Secondly, volumetric efficiency is held constant. Write for these free bulletins—No. 4401 for reciprocating pumps; No. 4502 for air or hydraulic mechanisms. Darling Valve & Manufacturing Co.

93—See page 174. Lattice-Braid Rod Packing: All strands are strongly lattice-linked together into a structural unit which holds together even when the packing is worn far beyond the limits of wear of ordinary braided packings. Write for free descriptive folder. The Garlock Packing Co.

94—See page 48. Plastic Packing: versi-pak —the new plastic packing which is the result of more than two years of testing and development. Send for a free copy of the versi-pak bulletin which contains complete details on uses. Raybestos-Manhattan, Inc.

95—See page 157. Packing Cups: Write for further information about Johns-Manville Moulded Packing Cups which are custom-made for precise fit to lower friction and wear on liners and to reduce amount of power required. Johns-Manville.

PIPE AND FITTINGS

96—See page 129. Data Book on Welding Fittings and Forged Steel Flanges: Catalog 484 gives information on welding fittings and forged steel flanges. Contains engineering data for the man who purchases, designs or specifies piping, fittings and flanges. Taylor Forge & Pipe Works.

97—See page 169. Flexible Metal Tubing: Complete Catalog on request describing this all metal tubing that meets temperature requirements of practically any application. Titeflex, Inc.

98—See pages 66, 67. Gun-Pakt Expansion Joints: Send for free Bulletin EJ-1912 for the full story on Yarway Expansion Joints. Insert a plug of packing, turn a wrench, the joint's tight and all under full steam pressure. Write today. Yarnall-Waring Company.

99—See page 29. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. Ask for Publication C-24. The American Brass Company.

100—See page 161. Pipe Markers: Quik-Label pipe markers conform to American Standards Association Pipe Identification System. Stick without moistening. Can be read up to 75 feet. Specials made to your order. Send for useful literature and FREE SAMPLE today. W. H. Brady Co.

101—See page 123. Welding Elbows: One of several reasons why many users prefer Midwest is the variety of welding elbows avail-

(Continued on page 30)

"These brick have been in service since you were born!"

NEARLY A GENERATION AGO, a large copper mining company relined the rear walls of two B&W boilers with B&W 80 Firebrick. For 17 years of constant operation at high ratings these brick provided top, trouble-free, maintenance-saving service.

Today, B&W 80's are one of a wide range of superior B&W Refractories — all designed to give the type of service that means profitable operation. Here, for example, are five B&W castables that will help you speed furnace construction:

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for temperatures up to 3100F

KAOCAST

for temperatures up to 3000F

B&W HYDROCHROME

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for temperatures up to 2200F

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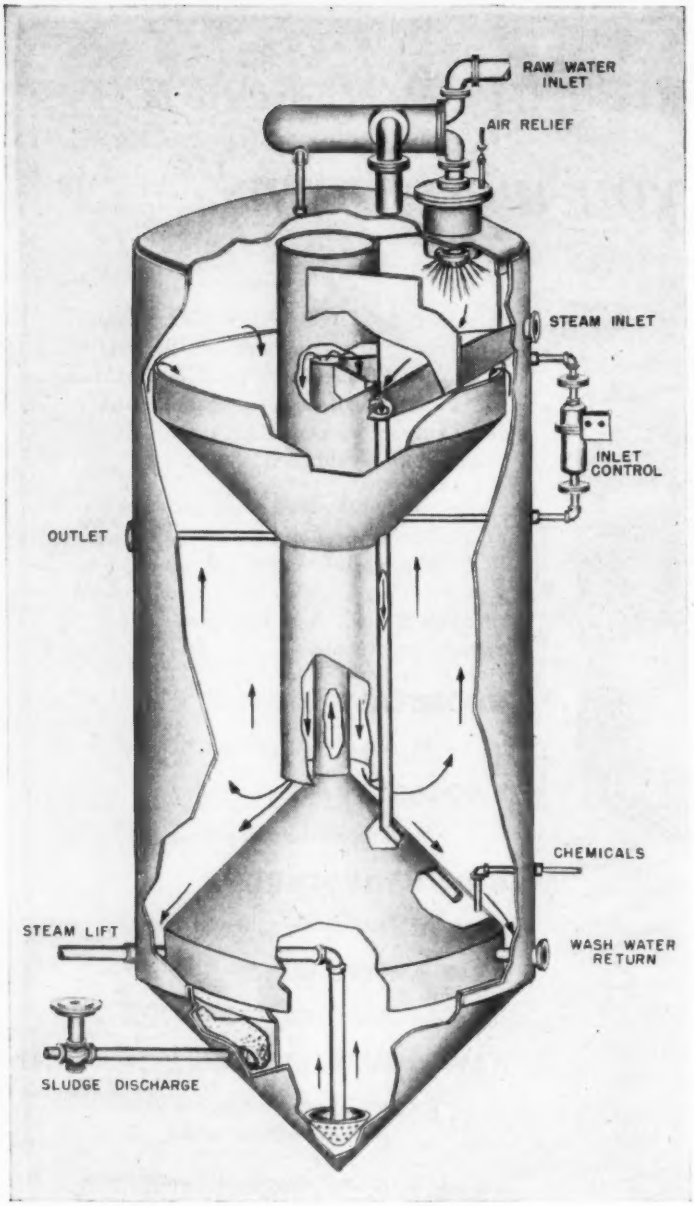

New HOT PROCESS WATER TREATMENT

Deaerates and Softens Simultaneously!

FOR the first time, INFILCO has combined within a single, compact unit, features the power plant operator has long wanted! The new Deaerating Hot Process ACCELATOR® features a *steam lift* which produces internal slurry recirculation without mechanical devices. The same steam lift efficiently deaerates the water undergoing treatment, thereby eliminating separate deaerating mechanisms. Silica is reduced to a new low, because the Hot Process ACCELATOR provides for prolonged slurry contact as well as the redissolving of the magnesium in the slurry, which is later reprecipitated. This brings a saving in chemicals.

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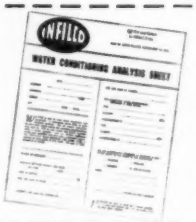
Make sure your water meets the exacting specifications you require. Send for our Water Analysis Sheet, then fill in and return it with a sample. You will receive our laboratory analysis and report promptly. A valuable INFILCO CHEMICAL CALCULATOR slide rule sent FREE to all who return our analysis sheet properly completed. *No cost or obligation is involved for this laboratory service.*



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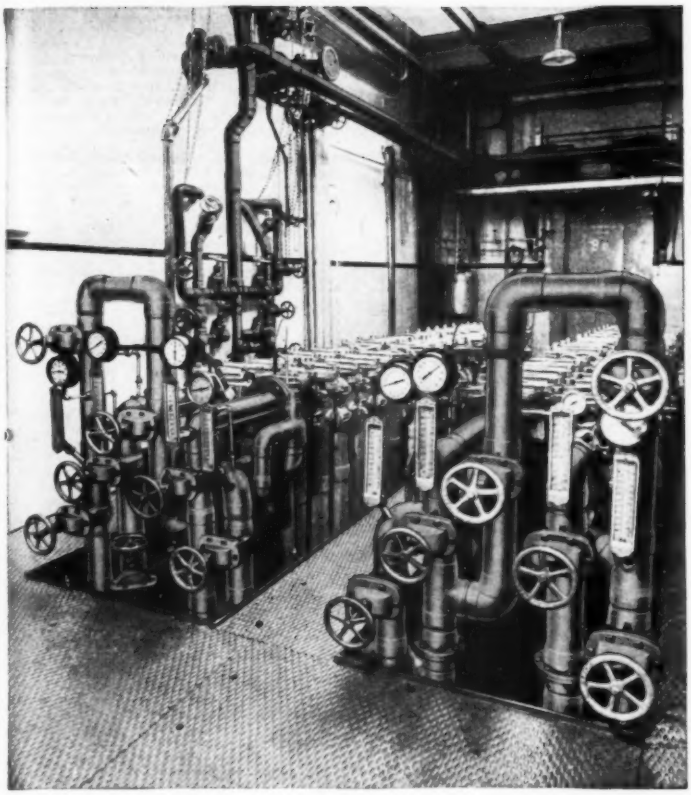
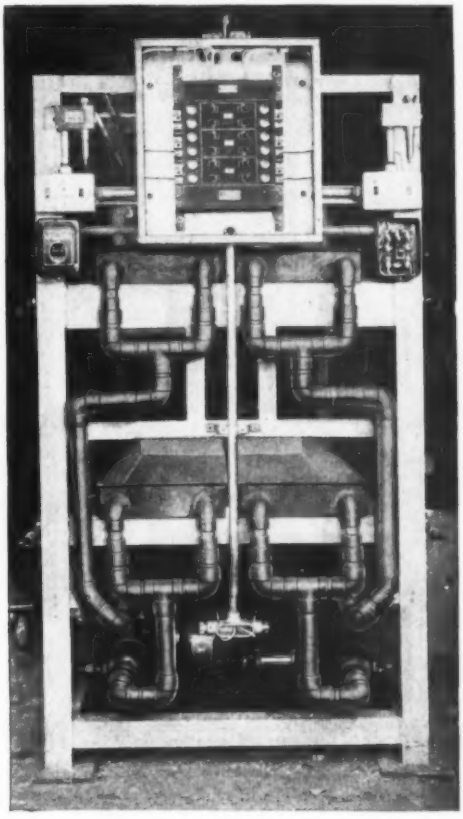


(*Left*) Copper pipeline installation for wort coolers at the F. & M. Schaefer Brewing Co., Brooklyn, N. Y.

(*Below*) Pilot plant equipment in the laboratories of Chas. Pfizer & Co., Inc., Brooklyn, N. Y., manufacturers of fine chemicals and pharmaceuticals.



For Carrying Hot or Cold Water, Gases, Compressed Air, Refrigerants, Oils . . .

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YOU save three ways — on installation time, on maintenance and on long-term service.

Copper tubes are speedily installed with solder-type fittings. Because soft-annealed copper tubes can be bent to clear obstructions, fewer fittings are needed in many types of installation. Joints can be made readily in cramped spaces. Easy to set up, copper tube pipelines are equally easy to dismantle.

Solder fittings give uniformity of bore to copper tube piping; flow is unimpeded at joints, and the rust-free surface of copper means a low coefficient of friction, with reduced pumping costs. The corrosion resistance of copper provides assurance against premature pipe replacement and excessive maintenance.

Whether you require capillary tubes of .025" I.D. or cold-drawn seamless tubes as large as 26" I.D., ANACONDA Copper Tubes offer basic advantages found in no other single piping material. Write for ANACONDA Publication C-24, containing detailed information on the industrial applications of ANACONDA Copper Tubes. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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ANACONDA *Copper Tubes in commonly used types and sizes are stocked by wholesale distributors from coast to coast.*

4071 Rev.

For better Piping . . . use **ANACONDA COPPER TUBES**

READERS' GUIDE

(Continued from page 26)

able. If you do not have complete information in your files, write today. Midwest Piping & Supply Co., Inc.

102—See page 52. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass Company.

103—See page 155. Pipe Unions: Bronze-to-bronze ball joints insure long life and tight joints. Because of precision in manufacture these unions can be disconnected and reinstalled many times. Send for complete information today. E. M. Dart Mfg. Co.

104—See page 172. WECO "Junior" Unions: Made for 3,000 lb, non-shock cold working pressure, in sizes 1/8" thru 2". Illustrated brochure available for complete information. Write for your copy today. Weil Equipment Mfg. Corp.

105—See page 64. Power Piping: Catalog No. 49 (it's new) gives you full details on fabricated piping, valves and fittings, piping accessories, and all the pipe for any piping system and fore any working condition. Send for your copy today. Crane Co.

106—See page 65. Flexible Metal Hose: Now available, Bulletin 102, an application guide for CMH Flexible Metal Hose. Also other literature giving full details on expansion joints, bellows and specialty items is yours for the asking. Chicago Metal Hose Corp.

107—See page 172. Steel Work Bench: Interchangeable units readily adaptable to individual requirements. Rigid, heavy-duty construction eliminates bolting to floor. Full details in Bulletin 701. Standard Pressed Steel Co.

PLANT EQUIPMENT

108—See page 112. Electroforged Steel Grating: Provides safe footing with maximum open area for admission of light and air. Send for bulletin 2296. Blaw-Knox Div. of Blaw-Knox Co.

109—See page 140. Dry Chemical Type Fire Extinguisher: Now ready with features that make it one of the most efficient, foolproof, easy-to-use fire extinguishers known. 20 pound and 30 pound capacities. Write now for complete free information on this newest contribution to modern fire fighting. C-O-Two Fire Equipment Co.

110—See page 146. Steel Grating: Bulletin JY 1140 fully describes the Dravo line of Trilok grating, safety treads, open steel flooring, concrete armoring and other products. Send for your free copy. Dravo Corp.

POWER TRANSMISSION

111—See page 178. Fan-Cooled, Worm Gear Speed Reducers: Write for Catalog 200 for standard drives, and Catalog 300 on Speedaires that do more work, deliver double the horsepower of standard worm units of same frame size. Save money, space, and weight. The Cleveland Worm & Gear Co.

112—See page 165. Belt Lacing: Flexible steel lacing in 12 sizes for transmission and conveyor belting of all kinds. Write for complete details and prices: Flexible Steel Lacing Co.

113—See page 3. Conveyor Belts: Call your nearest Goodyear Technical Man or write today for help in selecting the belt that will handle more coal for longer periods at less cost. Goodyear Tire & Rubber Co.

114—See page 62. Ball Bearing Pillow Blocks: Write for special SC Bulletin describing Dodge-Timken bearings and ball bearing pillow blocks that comprise the famous "30,000 hour line". Dodge Manufacturing Corporation.

115—See page 170. Flexible Couplings: New engineering catalog gives full information on these all metal couplings designed to eliminate backlash, friction, wear and cross-pull. Thomas Flexible Coupling Co.

116—See page 135. Roller Bearings: Designers and builders of every type of machine or equipment requiring roller bearings look to Hyatt for the right bearings—right in design and precision manufacture—to assure care-free operation and longer-lasting performance. Write for complete information on Hyatt roller bearings. Hyatt Bearings, Div., General Motors Corp.

117—See page 139. Pillow Blocks: Five basic types for shafts from ½ inch to over 9 inches. There's an SKF pillow block that's exactly right for every job. Check your SKF Distributor or write for more information. SKF Industries, Inc.

118—See page 41. Chain Drives: Rex Chabelco line of chains and sprockets are specifically designed for drive service on equipment where steady, uninterrupted service is a "must". Many sizes now available from stock. For all the facts on their lower over-all cost, write Chain Belt Company.

119—See page 121. Diamond Roller Chains: If you use or build automatic machinery, you'll find it pays to insist on Diamond Roller Chains. Practical suggestions from specialized engineering staff and Catalog No. 709 are yours for the asking. Diamond Chain Co., Inc.

PUMPS

120—See page 168. Free Bulletin: For complete information about Viking Pumps, write for Bulletin 50SG. You'll find the style and size you need, correctly engineered to do your job. Viking Pump Company.

121—See page 154. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

122—See page 159. Deep Well Turbine Pumps: Vertical, multi-stage construction of these units make it possible to utilize underground water sources at almost any depth below the surface. For more information on their advantages for factory water supply and other uses, write for free Bulletin No. 4700-8. The Deming Co.

123—See page 112. Weinman Pumps: Designed and manufactured by Centrifugal Specialists who are concerned with but one product . . . pumps that work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. An inquiry will get prompt attention. The Weinman Pump Mfg. Co.

REFRACTORIES

124—See page 165. Refractory Cement: This plastic Chrome can be poured into any shape or form or can be installed with a cement gun. Refractory & Insulation Corp.

125—See page 178. Boiler Seam Protector: Bulletin describes a durable, refractory girth seam protector which will stop further leaking and fire-cracking on old seams; prevent leaking and fire cracking on new seams. National Boiler Protector Co.

126—See page 27. Refractories: Write for details on the B & W Refractories. Learn how they can cut operating costs in all types of industrial furnaces—large or small. The Babcock & Wilcox Co.

127—See page 151. Higher Boiler Efficiency: Fulletins are available for each of these Plibrico products that make boiler operation better and maintenance easier: Jointless Firebrick, Castable Refractories, Boiler-Wall Coating, Hyrate and Demon Cements. Check coupon on page 151 for the bulletins you want. Plibrico Jointless Firebrick Co.

REGULATORS AND CONTROLS

128—See page 39. Reducing and Desuperheating Control: Swartwout supplies the combination of equipment best suited for exacting control of the output of modern higher pressure boilers. For a modern, completely automatic reducing and desuperheating station, check your plans with Swartwout. The Swartwout Co.

129—See page 176. Multiport Valves: Use electrically operated H&T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

130—See page 165. Pressure Regulators: Davis No. 13 valve is recommended for use where a restricted flow of steam, air or gas is required at reduced pressure. Single-seat valve is tight-closing, non-sticking. For full details on No. 13 and other Davis pressure regulators, write for a copy of Bulletin No. 100-A. Davis Regulator Co.

131—See page 143. New Bulletin: Bulletin 443-B contains condensed data on all major Copes products. Handy for quick reference. A bulletin you should have in your Copes file. Write for your copy now. Northern Equipment Company.

132—See page 127. Temperature Indicating and Recording Regulators: Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating. Write for Bulletin 370 which shows the variety of models available. The Powers Regulator Co.

133—See page 122. Pressure Regulators: Masoneilan Regulators are giving accurate pressure reducing service in various types of applications. The No. 227 regulator, for instance, accurately maintains uniform industrial water pressures. Write for more information on this or other regulating problems you may have. Mason-Neilan Regulator Co.

134—See page 13. Automatic Feedwater Regulation and Combustion Control Systems: Complete information and application data is available for the asking on Hagan Combustion Control, Hagan Automatic Feedwater Regulation and Hagan Ring Balance Meters. Write today. Hagan Corporation.

STEAM TURBINES AND ENGINES

135—See page 68. Terry Turbines: Write for bulletin giving interesting facts about the outstanding features that make the Terry Solid-Wheel Turbine such a dependable driver. The Terry Steam Turbine Co.

136—See pages 22, 23. New General-Purpose Turbine: The new "Type E" gives you, in one standard unit, all the best features of previous Westinghouse drives plus many important refinements and new developments. Get the full story by writing for the "Type E" Turbine Book B-3896. Westinghouse Electric Corp.

137—See page 34. Turbines: Write for Bulletin 135 which explains the pilot operated excess speed safety trip which only Coppus Turbines offer you for extra protection for your turbine investments. Coppus Engineering Corp.

138—See page 20. Auxiliary Turbines: Bulletin SW-48 supplies specific details on vertical units for pump drives, turbine and gear combinations, and steam turbine for auxiliary drives. Write for your copy. L. J. Wing Mfg. Co.

TOOLS AND SMALL SPECIALTIES

139—See page 136. Pipe Tools: New Catalog, Number S-48, is free for the asking. Contains full information about these improved pipe tools. Send for your copy now. Armstrong Bros. Tool Co.

140—See page 134. Tube Cleaners and Expanders: Write for data on Airetool's cleaner and expander for types of tubular construction in your plant. Airetool Mfg. Co.

141—See page 163. Pipe Tools: New Automatic Switch Lock and Chuck Wrench holder plus the new Eccentric Spool Pipe Centering Device make the Beaver Model A Pipe and Bolt Machine better than ever before. Write today for new Beaver Catalog No. 50. Beaver Pipe Tools, Inc.

142—See page 44. Sockets and Wrenches: Want to reduce maintenance costs? Then send for Catalog No. 19. Lists thousands of plain and universal sockets, adapters, extensions . . styles, dimensions, type and size of drives, drawings and prices. Yours for the asking. The Apex Machine and Tool Co.

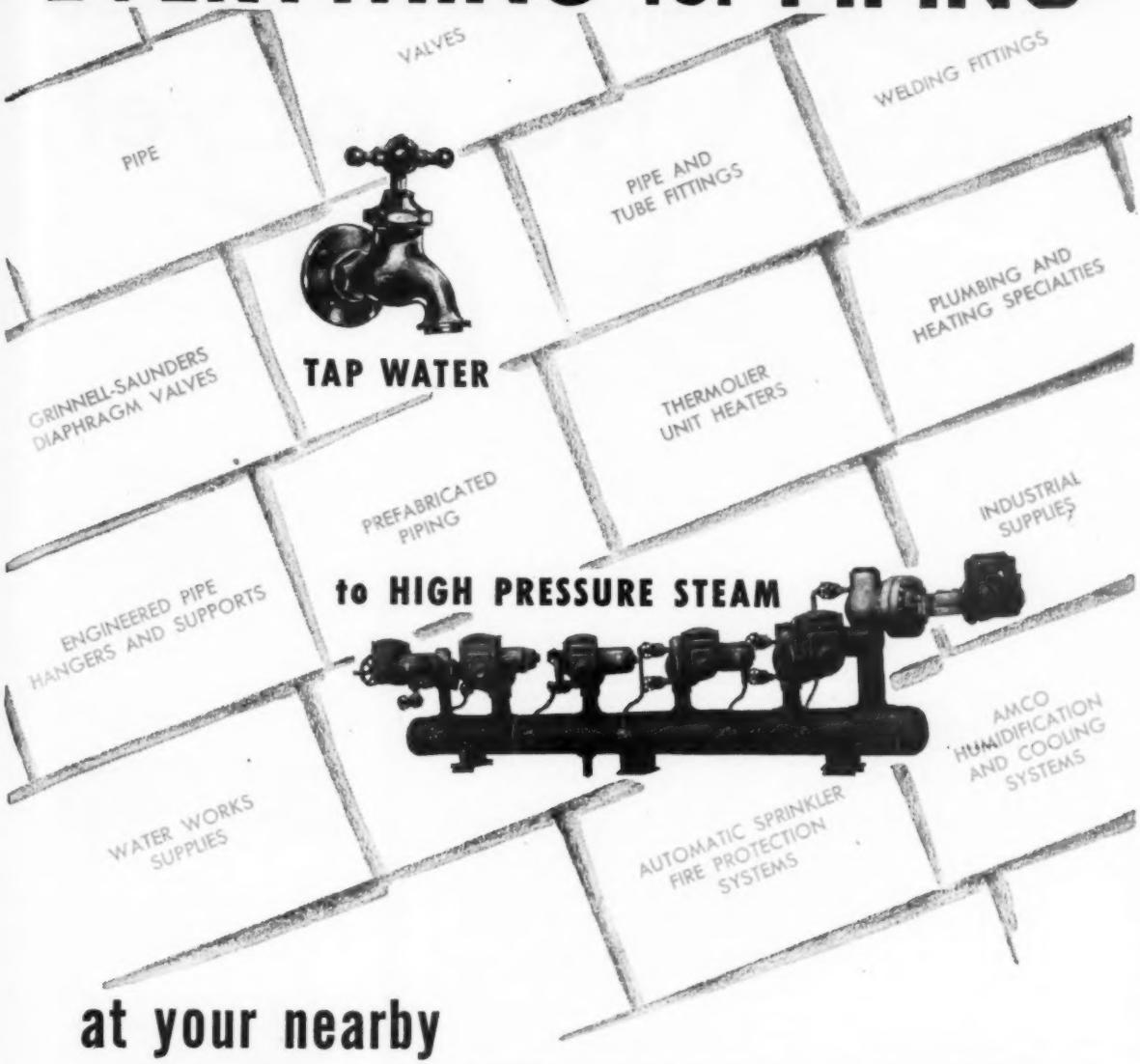
143—See page 113. Pipe Cutters: Burr-free cutting for all kinds of pipe and conduit. Every cutter factory-tested. Choose from five sizes to 6" pipe; four-wheel cutters to 4". More information and prices on request. The Ridge Tool Co.

TRAPS, STRAINERS AND SEPARATORS

144—See page 171. New Life for Old Webster Traps: It's simple, inexpensive, and all the work can be done right on the job when you use Webster Trap Attachments. The cost of repairs will be returned many times over in better trap performance, no wasted steam, faster heating-up, fewer complaints. Write for Bulletin B-800. Warren Webster & Company.

(Continued on page 33)

EVERYTHING for PIPING



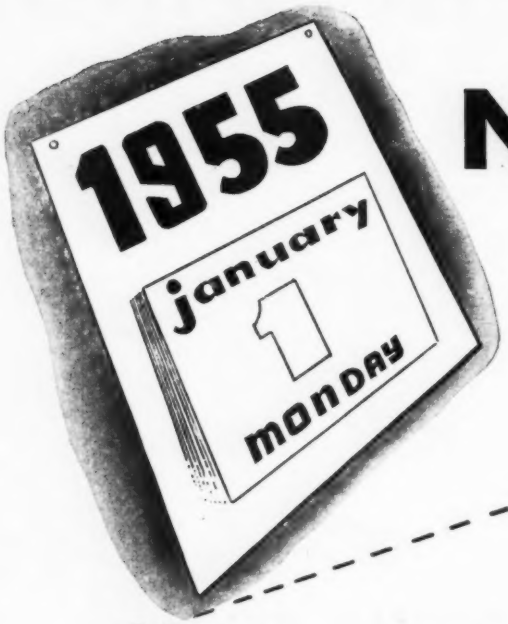
at your nearby GRINNELL WAREHOUSE or JOBBER

More than 1000 Grinnell warehouses and jobbers . . . one within easy reach of your phone . . . are ready to give you prompt delivery on any standard piping product. When the job calls for specialized piping products or installations, Grinnell has the manufacturing facilities, products, experience and engineering knowledge to "deliver the goods."

100 - ANNIVERSARY PIPING

GRINNELL

Grinnell Company, Inc., Providence 1, R. I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



No, not yet, but....

MARLEY FANS, GEAREDUCERS, DRIVE SHAFTS AND FAN CYLINDERS ARE *FIVE YEARS AHEAD* IN THE FIELD OF COOLING EQUIPMENT . . . since, the HEART of any Cooling tower or DriCooler is these mechanical units, their dependability and performance are of the utmost importance.

Just imagine mechanical equipment of any type . . . particularly 22 foot fans powered by 75 brake horsepower . . . operating 24 hours a day in the midst of a hot, dank jungle! Yet, this is the atmospheric condition under which mechanical units must perform on water cooling equipment.

Recognizing this fact, and realizing that commercial-type equipment was not available to meet these severe conditions, The Marley Company, Inc., decided in the early thirties to design and produce their own.

Today, Marley offers newly designed Geareducers, fans, fan cylinders and drive shafts . . . developed not from theory, not from a few scattered tests over one or two years' time, but backed with the "know-how" gained from MORE THAN 5000 UNITS actually in operation over the past fifteen years! This is 5 TIMES THE EXPERIENCE OF ANY OTHER manufacturer.

Of course, your next Marley DriCooler or Cooling Tower will have this "years ahead" mechanical equipment. But, you can modernize your present installation, if you wish, with Marley mechanical equipment which is now available in a range of sizes to fit most any cooling unit.

If you would like to know more about Cooling Tower or DriCooler Operation, Maintenance, Testing, Water Distribution, Specifications, Water Treatment, Air Movement, and other vitally important cooling problems, MAIL THE COUPON or write today for free, illustrated folders.

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas IP2

☐ Yes, I would like to have your FREE, illustrated folders on cooling problems.

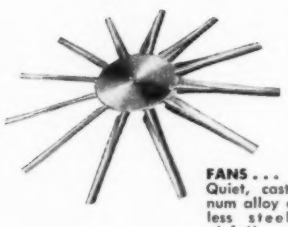
☐ Please have salesman call to discuss our cooling problem.

Name_____ Title_____

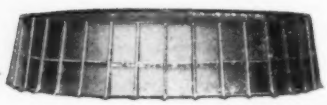
Company_____

Street Address_____

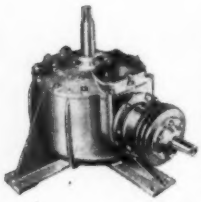
City_____ State_____



FANS . . . Quiet, cast aluminum alloy or stainless steel, true airfoil sections, adjustable pitch, smooth, efficient, balanced.

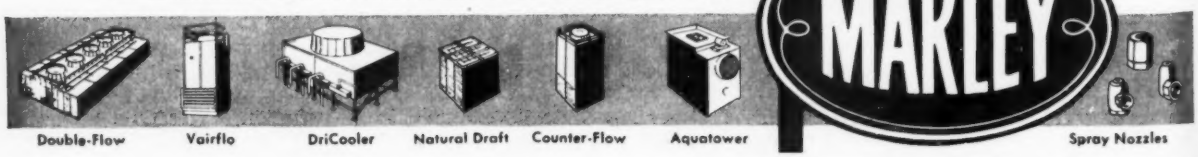


FAN CYLINDERS . all bolted construction (not nailed together) tapered throat, non-corrosive materials, high enough for safety, low enough for easy inspection, sized to give close fan tip clearance.



GEAREDUCERS . . . heavy cast iron cases, case hardened nickel-moly steel gears, Parco lubrized pinions, positive lubrication forward and reverse, sized and geared to meet operating horsepower.

DRIVE SHAFTS . . . Heavy tubular steel with integral yokes, flex-disc couplings, balanced for smooth operation, do not require lubrication.



MARLEY

READERS' GUIDE

(Continued from page 30)

145—See page 148. Trap With No Moving Parts: Provides continuous and complete air and condensate elimination, and visual operation indicator; requires no by pass; fits into line like a valve. Write for Drainator Catalog. The Coe Mfg. Co.

146—See page 2. Steam Trap Handbook: Tables, charts, diagrams and rules for selecting traps, giving complete explanations, make the new 36-page book a handy reference volume for every engineer's library. Send for Armstrong Steam Trap Book. Armstrong Machine Works.

147—See page 120. Steam Traps: Catalog No. 448 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

148—See page 63. Pipe Line Filters: Staynew Double Action Pipe Line Filter's exclusive double action principle guarantees both clean and dry air. You get, in one unit, both mechanical separation and filtration. Complete data will be sent on request. Dollinger Corporation.

149—See page 175. Steam Specialties: Illinois Float and Thermostatic Traps are made in three series to meet a wide variety of applications and for operating ranges from 50 pounds pressure to 25 inches vacuum. Complete data gladly sent upon request. Illinois Engineering Company.

150—See page 107. ABC of Good Steam Practice: Check these important and essential ABC's of good steam practice in the advertisement on page 107. Bulletin No. 275 (Air in Steam) and Bulletin No. 1600 which helps you select the right Sarco Steam Trap are yours for the asking. Sarco Company, Inc.

151—See page 133. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

152—See page 21. Johnson Electrap: New Data Book has complete engineering information on high temperature condensate drainage with the Johnson Electrap. Write for your free copy today. Johnson Corporation.

VALVES

153—See page 183. Blow-Off Valves: Send for free booklet which describes Yarway's seatless valves designed to meet every service requirement. Indicate the pressure of your boilers for more specific information. Yarnall-Waring Co.

154—See page 58. Powell Valves: Made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type—Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves. Write for full details and descriptions. The Wm. Powell Co.

155—See page 172. Reducing Valves: Ask for regulating valve Bulletin No. 1-A. Use coupon on page 172 for information on other Atlas products. Atlas Valve Company.

156—See page 175. Valves: Bulletin "A-P" shows how Valvair's three body styles (2-way, 3-way, 4-way, and piped exhaust) plus many methods of actuating, provides over 103,000 variations to suit just about any possible set of requirements you may have. Send for your copy right away. Valvair Corp.

157—See page 56. New Valve Design: Chapman Valve List 960 has been improved to give more than 50% increase in strength of stem and wedge gate connection. Valve stems and gates with new connection are interchangeable with all List 960 valves now in service. Write for complete information. The Chapman Valve Mfg. Co.

158—See page 69. Bronze Gate Valves: Design construction and interchangeability are fully described and illustrated in Circular No. 574. Write for your Copy. The Lunkenheimer Co.

159 — See page 163. Flanged Silent Check Valves: Write for new tecnnical bulletin on this valve that has proven successful on

(Continued on page 170)

THIS LUBRICANT SAVES 7 TIMES ITS COST IN PRODUCING SHOES!

This nationally known tanner and manufacturer of work shoes and gloves writes us . . .

". . . You recommended to us LUBRIPLATE NO. 100 for lubricating the chain drive on our paddle wheels which turn the hides immersed in a solution in concrete vats. The chain, during use, is always soaked. The solution is sometimes acid and sometimes caustic. Up to the time of your recommendation, we had not found any lubricant that would stay on the chains for any appreciable time.

"Heretofore, the average life of a chain was approximately one year. We have applied LUBRIPLATE to these chains every two weeks for two years. Since then, not one new chain has required replacement, and they are still going strong.

"At this time it appears that *for every dollar we have invested in* LUBRIPLATE, *we have saved seven dollars* in chains with actual savings still to come."

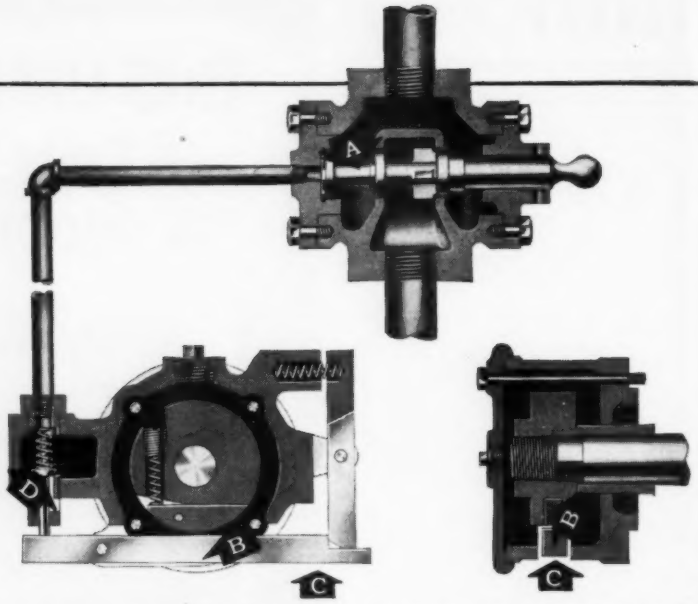
WOLVERINE SHOE & TANNING CORP.
Rockford, Michigan

You, too, can enjoy the savings made possible with LUBRIPLATE Lubricants. There is a LUBRIPLATE product for every industry. LUBRIPLATE reduces friction and wear, prevents rust and corrosion and is most economical to use. Write today for case histories of savings made possible by the use of LUBRIPLATE Lubricants in your industry.

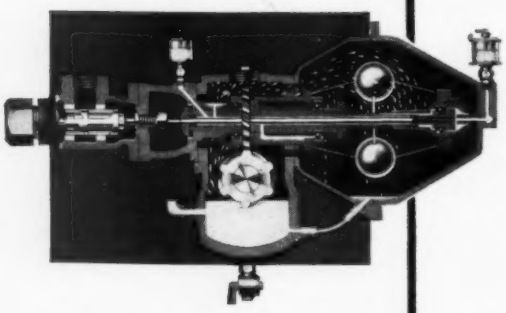
LUBRIPLATE DIVISION • Fiske Brothers Refining Company
Newark 5, New Jersey • Toledo 5, Ohio
DEALERS EVERYWHERE • SEE YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE the Modern Lubricant

Only Coppus Turbines offer you *a pilot operated* excess speed safety trip



The constant speed governor on Coppus Turbines, plus this Excess Speed Safety Trip, gives you extra protection for your turbine investments. Here's how it works. When steam is turned on, pressure opens valve A fully. When excess speed is reached, centrifugal force throws weight B against lever C lifting pilot valve D. This releases pressure in back of valve A, closing this valve instantaneously, to shut off the steam. Safety trip can be tested easily while turbine is running by manually tripping and resetting lever C.



Sectional view showing lubricating system of fully enclosed Coppus Constant Speed Governor. Governor head acts directly on stem of steam admission valve. No external levers required. Ball bearing construction eliminates end play and gives frictionless operation.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

CUT YOUR COSTS PER HORSEPOWER

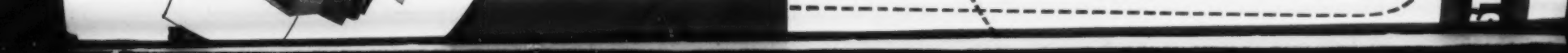
When you choose from the Coppus Steam Turbine line, you get the right size for your requirements . . . and make substantial savings on *any* size from the 150 hp turbine down to the smallest. Low in first cost, Coppus Turbines save you more money in the long run. Operating and maintenance costs are kept low by such other features as: large number of steam nozzles, controlled individually by manually operated valves; hard chromium plating on shaft at the stuffing box; replaceable cartridge type bearing housings; optional carbon ring packing assembly for back pressures up to 75 pounds.

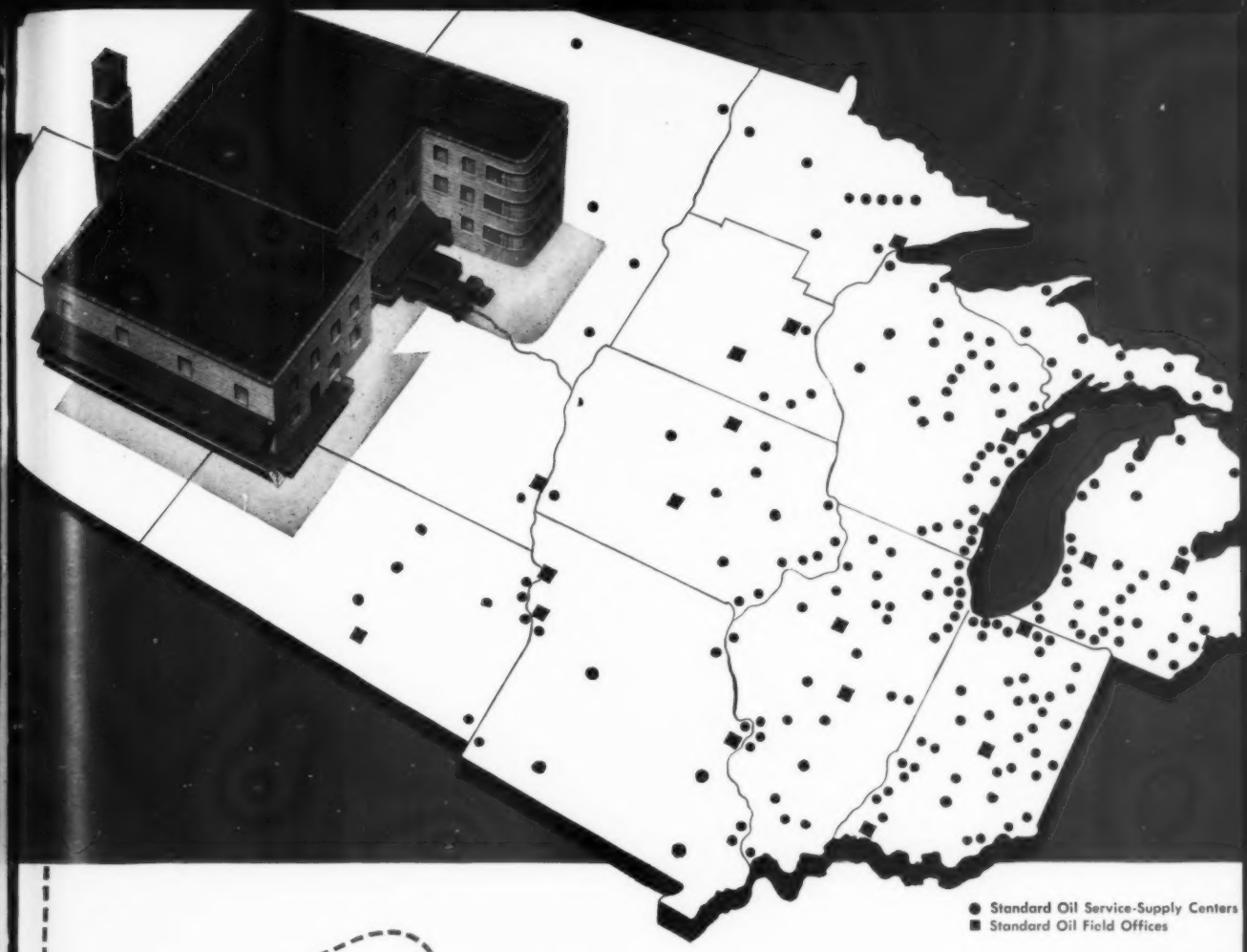
WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION, 182 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

1950





Right in your own back yard!

● If your plant is in the Midwest, you can benefit from a service-distribution set-up that is unique in the oil industry—there's a Standard Oil office and warehouse practically right in your own back yard. The nearness of that service-supply center holds important advantages for you.

Faster Deliveries. You needn't worry about production delays caused by late shipments of necessary lubricants and fuels. You can avoid the expense and trouble of stocking large quantities of lubricants and fuels within your plant.

A Complete Supply. Every lubricant and fuel necessary to the efficient operation of your plant will be carried in the warehouse at your nearby Standard Oil service-supply center. You can always get the product you need *when* you need it.

On-the-Spot Engineering Service. Your nearby Standard Oil service-supply center is headquarters for a Standard Oil Lubrication Specialist who is assigned to your plant. He is close at hand to give you help when you need it. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

To arrange for his visit, phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

1 **Service-supply points** are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 **Lubrication specialists** have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 **Research and technical facilities** are geared to help solve your specific lubrication problems.

STANDARD OIL COMPANY (INDIANA)

STANDARD

What's YOUR problem?

R. L. Jenkins, lubricating specialist at Standard Oil's South Bend office solved this customer's problem because he was thoroughly familiar with job requirements and the application of his Stanorust line.

• There is a corps of such lubricating specialists throughout the Midwest, trained and experienced to help plant operators solve similar problems. Experience enables these men to find quickly the cause of lubricating troubles. Knowledge of petroleum products enables them to prescribe the lubricant needed. There is one of these lubricating specialists at the Standard Oil Company (Indiana) office near you. He is there to serve you. A call or a card will put him at your service.

Investigate the cost-saving possibilities of these lubricants.

STANOIL INDUSTRIAL OILS—for cleaner hydraulic systems, gear cases, compressors, and circulating systems.

CALUMET VISCOUS LUBRICANTS—adhere to open gears and chain drives without throw-off. Easy to apply. No heating.

STANOLITH GREASE—withstands high temperatures and resists washing by water.

THE SHOP FOREMAN of Hart Pressed Steel Corp., Elkhart, Indiana, exposes the clean metal surface beneath a coating of STANORUST 1-XC Rust Preventive by a simple wiping operation. The die shown has been protected against rust under severe outdoor conditions for over a year by STANORUST 1-XC.

How to prevent rust under severe outdoor storage . . .

RAIN, snow, heat, cold—plus coal soot from passing locomotives—could be expected to produce serious rust troubles in outside storage. The elements did, indeed, cause difficulties for the Hart Pressed Steel Corp., Elkhart, Indiana, which owns the truck and trailer dies shown above. Despite coatings of heavy oil, rusting was so severe that cleaning a die required at least three hours.

The problem was laid before a Standard Oil lubrication specialist. He pointed out that, to withstand severe outdoor exposure, a rust preventive with special qualities is needed. At his suggestion, the dies were coated with STANORUST 1-XC, a rust preventive especially developed for severe outdoor service.

Use of a STANORUST Rust Preventive has made savings for this company. Many of the dies have been exposed to the weather for over a year, yet STANORUST has kept them completely protected against rust. A die can now be cleaned and returned to service in a matter of ten minutes, as compared with the three hours previously required.

The new and improved STANORUSTS can mean big savings for you through more economical applications, better rust protection. There's a lubrication specialist near you who can help you get the most economical results. How you can obtain his services is described at left. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANORUST
REG. U. S. PAT. OFF.
RUST PREVENTIVES

STANDARD OIL COMPANY (INDIANA) STANDARD

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WICKWIRE ROPE

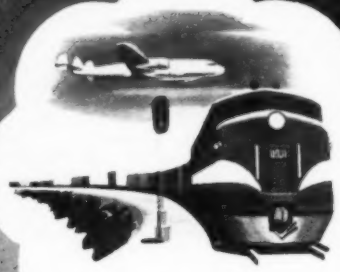
A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant—Palmer, Mass.

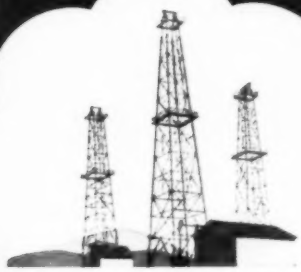
IN THE EAST—Wickwire Spencer Steel Div. of C. F. & I.—
[illegible] Fifth Ave., New York 16, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
[illegible] Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
[illegible]—10th Ave., Oakland 6, Cal.

LOGGING

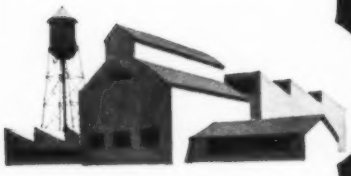


TRANSPORTATION

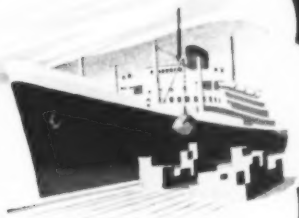
MINING



PETROLEUM



MANUFACTURING



MARINE

CONSTRUCTION

A. E. Brolmgo

COCHRANE

DEAERATING

HOT PROCESS SOFTENER

LOOKING UP . . . at
John A. Roebling's Sons Company

These illustrations show the 20,000 GPH (10,000 GPH condensate capacity) Cochrane Deaerating Hot Process Softener installed recently at the Roebling, N. J. plant of John A. Roebling's Sons Company.

Specifically designed for the treatment of raw water drawn from the Delaware River, the unit utilizes phosphoric acid introduced ahead of the preheater, followed by treatment with caustic soda beyond the deaerator.

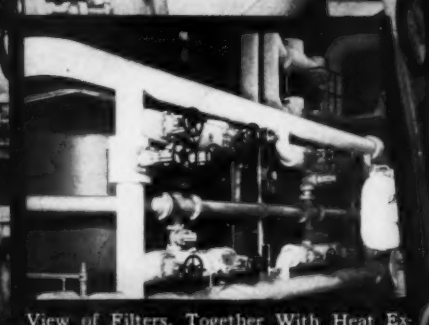
This unit has been operating with typical Cochrane effectiveness, guarding Roebling steam power equipment against scale and corrosion with water of zero hardness and zero oxygen, maintaining the boilers at peak efficiency, and producing clear boiler concentrate.

The Cochrane Hot Process Softener is applicable without modification to almost any water supply, hard or soft, turbid or clear. It is only necessary to feed the proper chemicals for the particular water being treated. The extreme versatility of the Cochrane Hot Process Softener, the low cost of installation and maintenance, plus the low cost of chemical reagents used by it make possible its application to a wide range of water conditioning tasks.

An interesting 66 page bulletin describing the Cochrane Hot Process Softener in complete detail and its application to many water conditioning problems is available. Write for a copy.

Cochrane Corp., 3108 N. 17th St., Phila. 32, Pa.
In Canada: Canadian General Electric Company, Ltd., Toronto

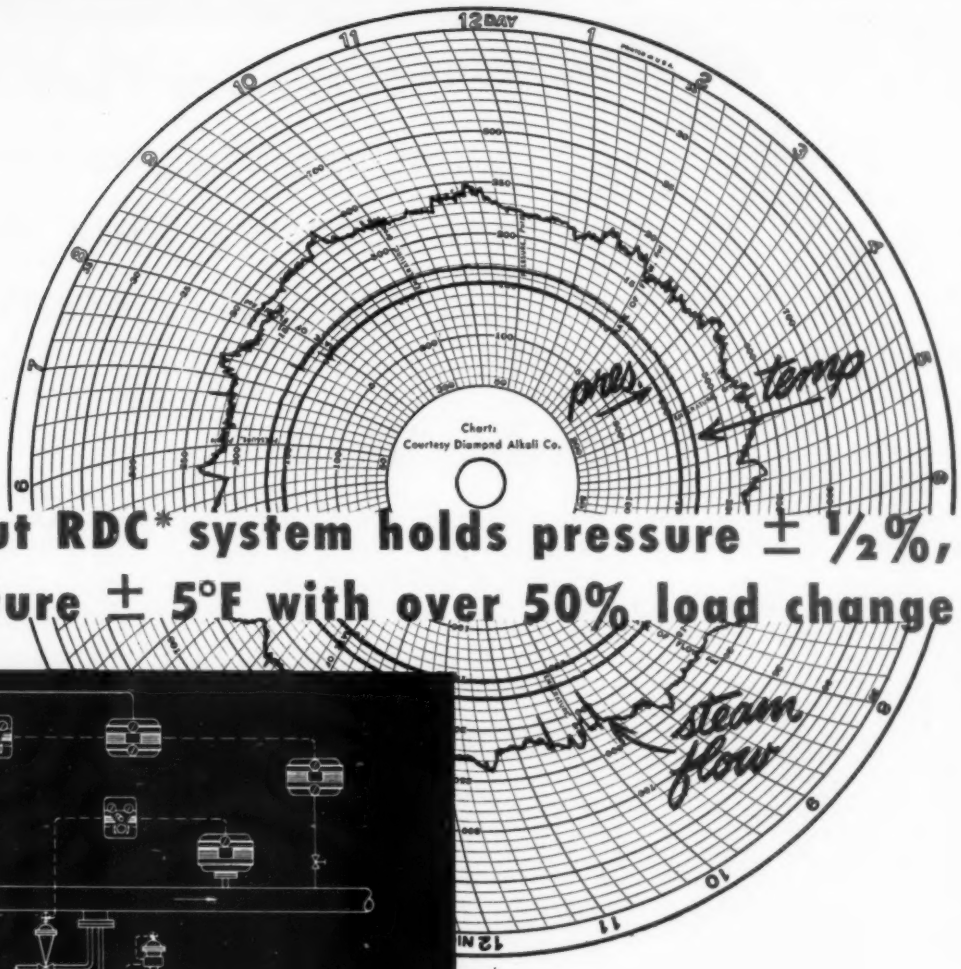
Continuous Blowoff Flash Tank.



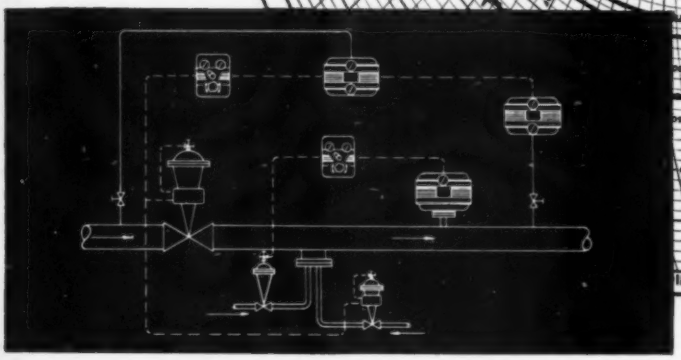
View of Filters, Together With Heat Exchanger and Sample Cooler.

COCHRANE CORPORATION 87 YEARS OF SERVICE 1853 - 1940

COCHRANE CORPORATION · · · · · · PHILADELPHIA 32, PA.



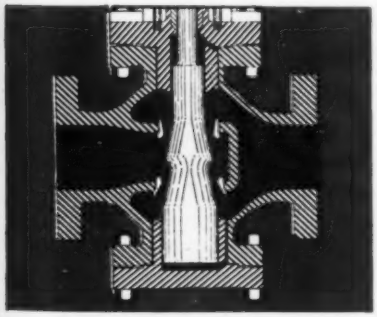
Swartwout RDC* system holds pressure ± ½%, temperature ± 5°F with over 50% load change



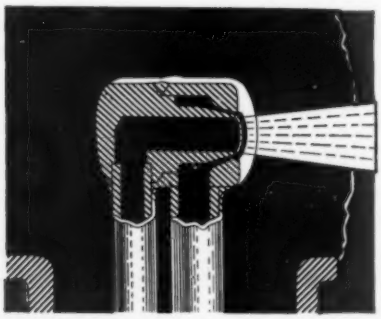
1 **RDC*—Reducing, Desuperheating and Control—represents a single problem** for which Swartwout assumes unit responsibility. Diamond Alkali Co. No. 4 RDC station at Painesville, Ohio, handles 200,000# steam per hour with reduction from 1450 to 152 psi; temperature from 900° to 438°F. Chart above shows the precision control of the Swartwout RDC system.

Swartwout

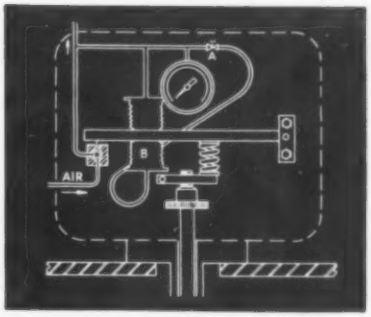
POWER PLANT EQUIPMENT



2 **REDUCING VALVE** for high pressure and temperature applications utilizes rugged construction and larger diameter stem to assure smooth action and long life. Disc and seat contours form nozzle-shaped passages which minimize turbulence and eliminate undue noise and life-shortening vibration.



3 **STEAM ATOMIZING** desuperheater has nozzle in center of steam line for effective narrow-angle dispersion of completely atomized water. Nozzle is accurately machined for each installation to give high velocity with existing atomizing steam pressure. Swartwout also makes carburetor and mechanical atomizing types.

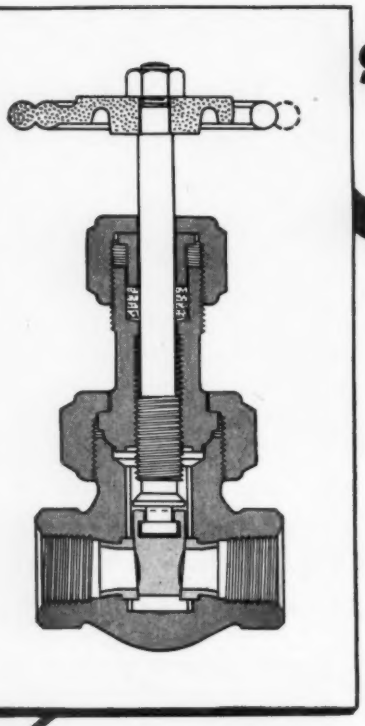


4 **TEMPERATURE CONTROL** combines wide throttling range with automatic load compensation for close temperature control. Needle valve A adjusts rate of flow to and from reset bellows B, establishing load compensating characteristic. Operation is stable regardless of load change and time lag. A-2572

SEND FOR BULLETINS S-21-E, S-22-C, S-199. THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

"Where can I get compact, high quality, high pressure Gate Valves for general service?"

"Order VOGT Series 9850"*



Operating men everywhere rate these valves as tops for general gate valve service including meter and gauge lines, drip and drain lines, etc. Series 9850 valves have drop forged carbon steel bodies and bonnets, rolled in 11½-13% chrome stainless steel seat rings which can be easily renewed, and a solid stainless steel wedge. A ground joint insures tightness between body and bonnet. The stuffing box can be repacked under pressure when the valve is open.

Also available is Series 9750, completely fabricated from 18-8 stainless steel for services where internal or external corrosion is severe.

Series 9850-F8 valves have 18-8 stainless steel trimmings and carbon steel bodies and bonnets.

*Series 9850

CARBON STEEL } 800 Pounds @ 750° F. 1500 Pounds Cold Non-Shock

For 150-800 pounds general service Union Bonnet • Ground Joint • Inside Screw Stem • Renewable Seat Rings • Solid Wedge — Slotted Type • 11½-13% Chrome Stainless Steel Trimmings Sizes ¼" to 2" inclusive.

HENRY VOGT MACHINE CO.
Louisville 10, Ky.

BRANCH OFFICES: NEW YORK • PHILADELPHIA CLEVELAND • CHICAGO • ST. LOUIS • DALLAS

Vogt DROP FORGED STEEL VALVES

NEED MORE "DRIVE" IN YOUR MACHINES?

Rex Light Chabelco . . . *for moderate loads*

Rex Universal Chabelco . . . *for heavy loads at higher speeds*

Rex 3100 Series Chabelco . . . *short pitch chain for high-speed service.*

Rex Heavy Chabelco . . . *for heavy loads*

If you want top performance from your machines . . . if you want drives that stand up under the toughest operating conditions, the Rex Chabelco Line of Chains and Sprockets is the answer.

Specifically designed for drive service on equipment where steady, uninterrupted service is a "must," these husky steel chains *deliver more H.P. per dollar* . . . assure low initial and operating costs . . . and freedom from production loss due to premature drive failure. Often a Rex Chabelco Chain, single or double strand, will handle loads that would require triple or quadruple strands in other types of chain.

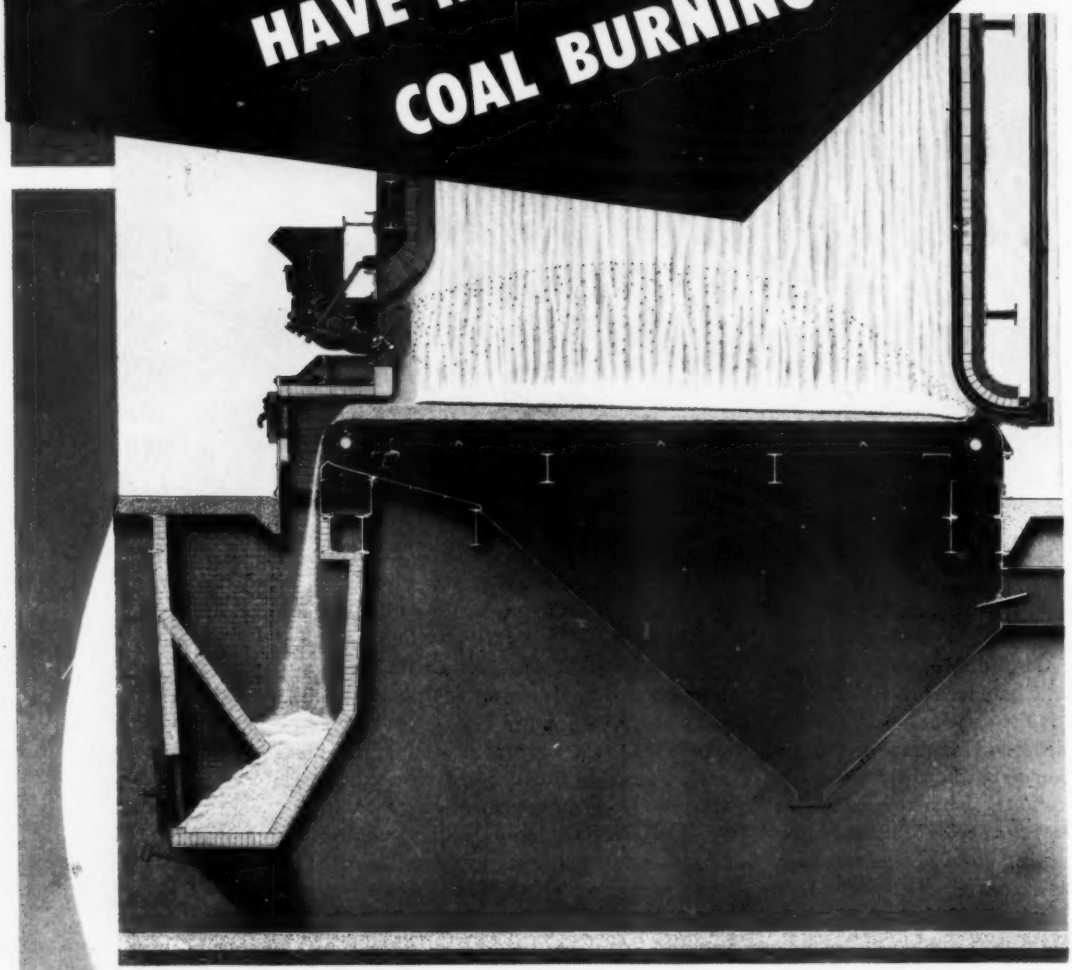
Where service is exceptionally severe . . . where equipment must operate under conditions of dirt, dust and temperature extremes, a Chabelco Chain will keep going when other driving mediums would soon fail. Designed-in clearances between working parts enable it to operate efficiently under these conditions and to accommodate minor misalignments.

Many sizes of standard Rex Chabelco Chains and Sprockets are now available from stock. For all the facts on how they can help you put more "drive" in your machines at the lowest over-all cost, call your Rex Field Office or write Chain Belt Company, 1650 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT COMPANY — REX — DRIVE AND CONVEYOR CHAINS

In the Past 10 Years

DETROIT ROTOGRATE STOKERS HAVE REVOLUTIONIZED COAL BURNING



Grates move forward slowly and continuously, automatically regulated in proportion to the quantity of fuel being burned.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES

Elected by Popular Choice!

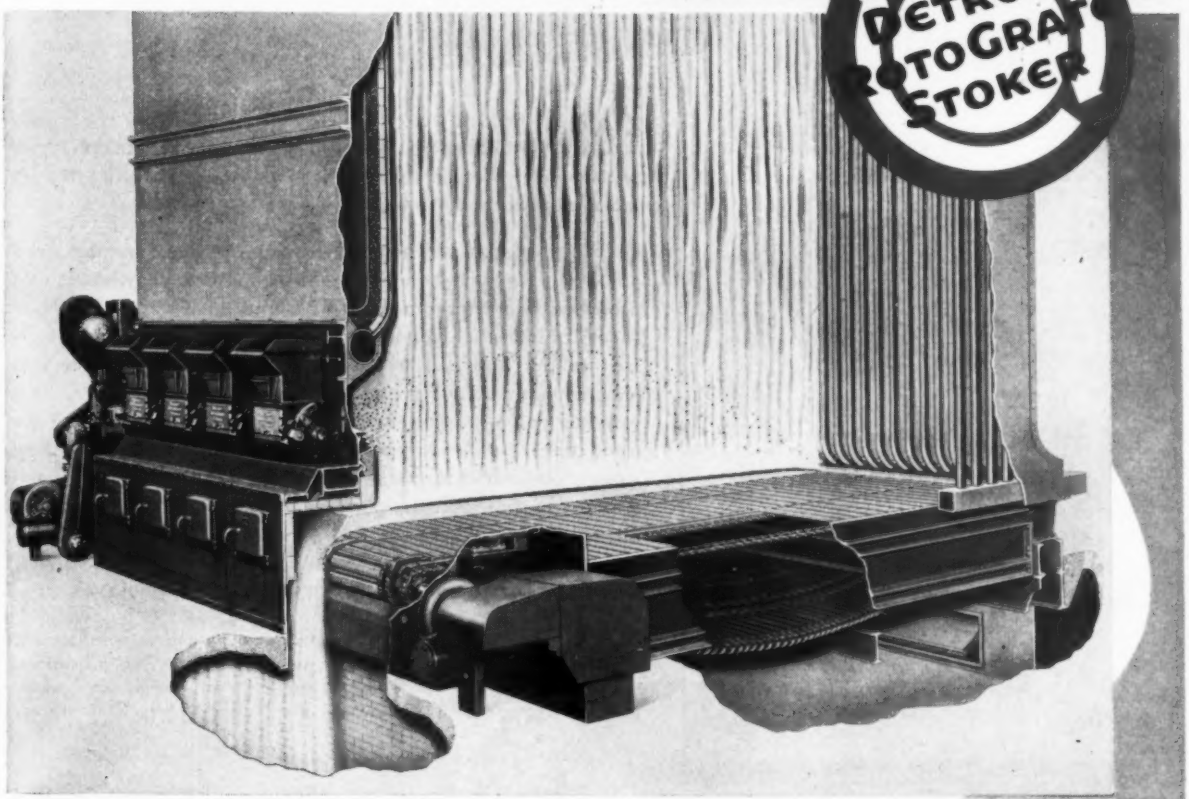
Several hundred Detroit RotoGrate Stokers are now installed or on order.

The successful record of the original forward moving, continuously cleaning spreader stoker.

Advantages Are:

- Higher burning rates demanded by modern steam generators.
- Continuous operation for long periods.
- Operate with high CO_2. Preheated air may be used.
- Burn high or low grade coal or lignite.
- No clinker or slagging difficulties.
- Requires little power for operation.

DETROIT ROTOGRATE STOKER



Detroit RotoGrate Stoker with six grate sections as applied to a typical water cooled furnace of a steam generator. Two of the six Rotors removed to show the overlapping grate design.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES

THE SAFE, SURE WAY TO **REDUCE MAINTENANCE COSTS**

standardize on

APEX

sockets and wrenches

Safe Because Apex sockets and wrenches are specifically designed for heavy-duty industrial service, and built to meet all safety requirements. With Apex, you can step up maintenance schedules—safely.

Sure Because Apex sockets and wrenches are machined from high carbon electric furnace alloy steel, cold broached and heat-treated to withstand the severe strains and shocks of industrial maintenance service. With Apex, longer service life per tool and freedom from excessive down-time cuts maintenance time and costs.

When you're buying maintenance tools, the first cost isn't the total cost. Your Apex representative will gladly show you how Apex maintenance socket wrenches can help you reduce maintenance costs—safely and surely. Prompt delivery from stock on thousands of standard items including the new large size sockets (up to 4⅝" hex opening) . . . immediate quotations, on special orders—just send your sketch or blueprint.

APEX SOCKET WRENCH CATALOG

Lists thousands of plain and universal sockets, adapters, extensions . . . styles, dimensions, type and size of drives, drawings and prices. Write, on your company letterhead, please, for Catalog No. 19.

APEX sockets and wrenches

THE APEX MACHINE AND TOOL COMPANY
1030 S. Patterson Blvd., Dayton 2, Ohio

SAFETY FRICTION TAPPING CHUCKS • VERTICAL FLOAT TAPPING CHUCKS • SELF-RELEASING AND ADJUSTABLE STUD SETTERS • POWER BITS FOR PHILLIPS, FREARSON, SLOTTED HEAD, CLUTCH HEAD, HEX HEAD AND SOCKET SCREWS • HAND DRIVERS FOR PHILLIPS, FREARSON AND CLUTCH HEAD SCREWS • AIRCRAFT AND INDUSTRIAL UNIVERSAL JOINTS • SOCKETS AND UNIVERSAL JOINT SOCKET WRENCHES.

"for all three call K&B"

...DESIGN...FABRICATION ...INSTALLATION of DUST & FUME CONTROL SYSTEMS

Dust control system showing grinding heads at Crescent Tool Co., Jamestown, N. Y.

For 42 years, Kirk & Blum has specialized in the DESIGN, FABRICATION and INSTALLATION of efficient, dependable systems for the removal of dust and fumes.

DESIGN: Kirk & Blum engineering specialists survey your plant and then design your system, selecting equipment most suitable for your problem.

CONSTRUCTION: Kirk & Blum fabricates the complete system (equipment excepted), "tailor made" for your installation.

INSTALLATION: The Kirk & Blum contract includes responsibility for the entire system, installed by mechanics with years of specialized experience in the installation of such systems.

Fume Exhaust System in plating room at S. E. Overton Co., South Haven, Mich.

● **As a result, you have one undivided responsibility—*one complete contract for an installed system, ready to operate.*** **The Kirk & Blum Mfg. Co., 2874 Spring Grove Ave., Cincinnati 25, O.**

Down Draft Dust Control System for Grinding and Snagging in machine tool shop.

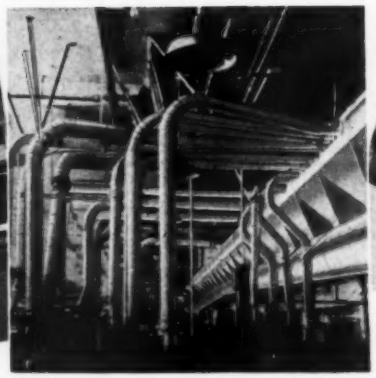
Write for any of the following booklets:
"Dust Collecting Systems in Metal Industries"
"Blower Systems for Woodworking Plants"
"Fan Systems for Various Industries"

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST & FUME CONTROL SYSTEMS

A Dust Control System installed in large woodworking plant.



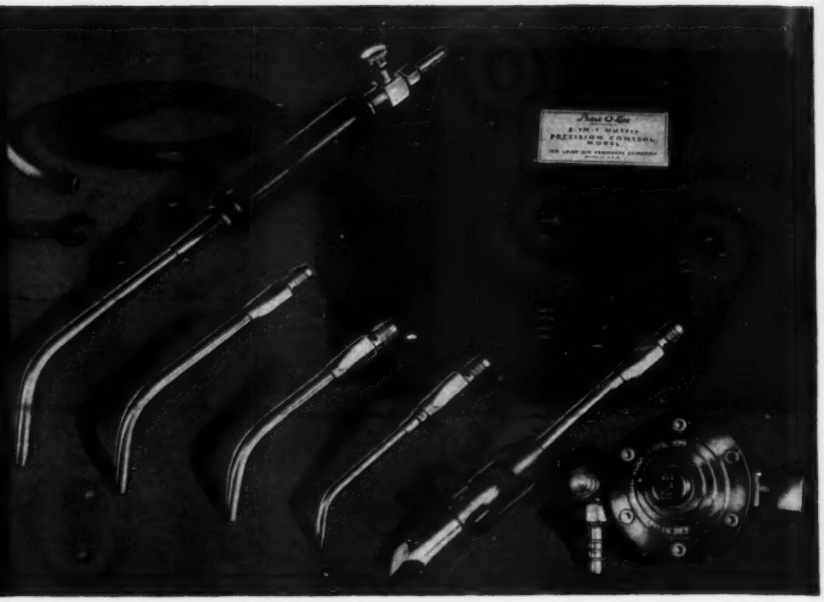
Plenum Type Dust Control System for production woodworking plant.

Dust and Fume Control in modern foundry of famous implement manufacturer.

Prest-O-Lite

PRECISION 5-in-1 OUTFIT

One Outfit · Hundreds of Uses



The Handiest Kit in the Shop for SOLDERING · HEATING · BRAZING

FULL WORK RANGE . . . Four stems and a soldering copper cover every air-acetylene job—from heavy soldering or heating to wire splicing or finest work on delicate instruments . . . Slender torch and stems . . . Easy to handle.

PRECISION CONTROL . . . Automatically regulated, constant gas pressure . . . Precise air-acetylene mixtures . . . Torch needle valve for *exact* flame adjustment.

INSTANT FULL-HEAT FLAME . . . No pumping, priming, or warmup . . . Immediate flame temperature of 2,800 deg. F., burning PREST-O-LITE acetylene from a single, convenient small tank . . . No smoke or fumes . . . Unaffected by wind or rain.

COMPACT . . . Handy steel carrying case (7 by 11 by 2 in.) holds entire outfit.

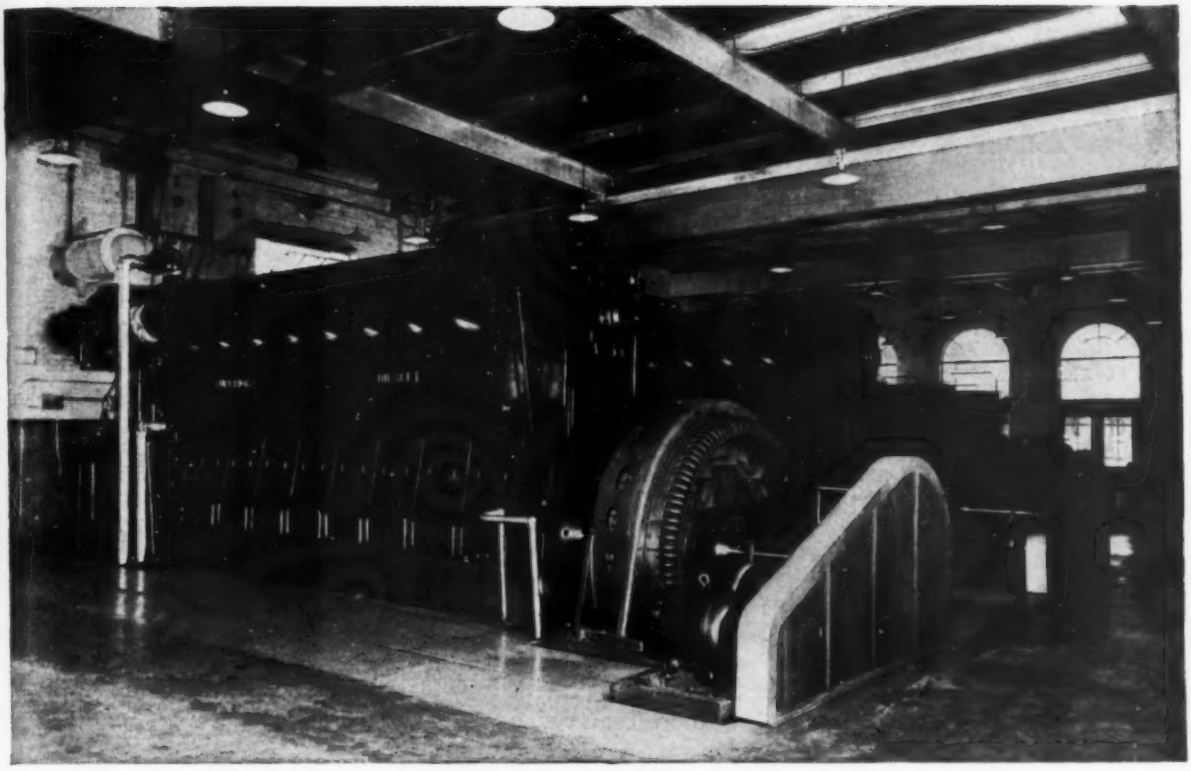
LIGHTWEIGHT . . . Only 5 lb. 13 oz.. case included.

5-in-1 Precision Outfit No. 09P84 (illustrated) is furnished with regulator that fits Style B PREST-O-LITE Gas Tanks of 40 cu. ft. capacity. For outfit with regulator that fits Style MC Tanks (10 cu. ft. capacity), order No. 09P85.

Order from Your Local Jobber

Your jobber can show you many time- and money-saving uses for PREST-O-LITE Air-Acetylene Appliances in your work. If you don't know him, write us for his name. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

The term "Prest-O-Lite" is a trade-mark of The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation



THEY BURNED THE MORTGAGE IN LESS THAN 10 YEARS

● An Arkansas town started a power generating plant over 10 years ago with three Superior Diesels. When they threw the switch on this new venture they had a $49,000 debt. In less than 10 years they burned the mortgage.

Since this municipal power plant started operations, it has paid over $122,000 in power dividends to the city . . . in free street lights, and 80% discounts to schools, churches, and charities. They added another Superior Engine in 1945 . . . still another in 1946 . . . and bought their sixth Superior Diesel in 1949.

In addition to these dividends and necessary capital improvements, operating profits made it possible to repeal a special tax assessment. Today this Arkansas power plant is debt-free and making a substantial annual profit. Its customers get the lowest priced electrical power in the locality.

Careful supervision plus low cost Diesel power have added another remarkable success story to Superior's files. Chances are a Superior representative can help you accomplish the same results. Why not write and tell us when he should call, or if you prefer, send for our fully illustrated 20-page booklet.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

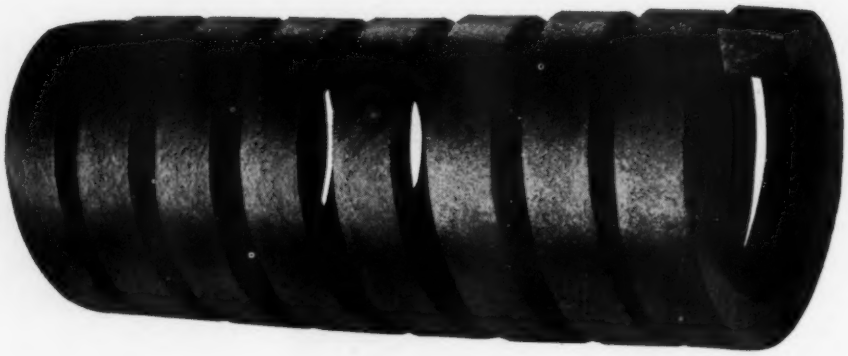
THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

versi-pak®

A NEW AND HIGHLY VERSATILE PLASTIC PACKING



versi-pak is the result of more than two years of testing and development. This new plastic packing can be used in an exceptionally large number of applications, and simplifies storage and inventory problems. It is being used successfully in reciprocating and centrifugal equipment and in hydraulic systems. Recommended for temperatures up to 350°F.; pressures up to 600 p.s.i.; against air, water, low-pressure steam, and a long list of chemicals. Available also in non-graphited form (R/M No. 1846) for use in food-handling equipment. For your free copy of the new bulletin on **versi-pak** send the coupon below to the Packing Division, Manheim, Pa.

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.
No. Charleston, S.C.; Passaic, N.J.

Raybestos-Manhattan, Inc.
Packing Division, Manheim, Pa.

Gentlemen: ☐ Please send me a free copy of the **versi-pak** bulletin.

Name_____

Position_____

Company_____

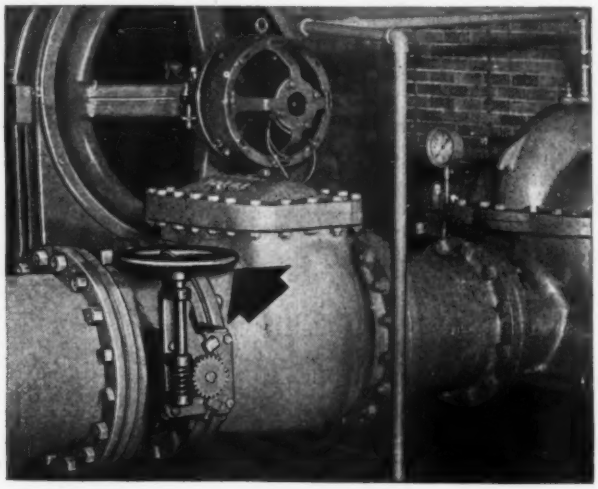
Address_____

City_____ Zone____ State_____

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment Brake Linings • Brake Blocks • Clutch Facings Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



6 HANDWHEEL TURNS OPEN OR CLOSE VALVE

This quick closing feature is an important consideration in water pumping operations as illustrated above or any application where a battery of synchronous driven pumps discharges into a common header.

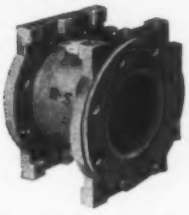
Normal procedure when starting a pump is to shut off the discharge valve until the pump has gained the desired speed. The valve is then opened gradually. Since it requires only a few seconds of an operator's time, this important operation is not likely to be neglected when R-S Valves are installed. Burned-out motors at start-ups can be practically eliminated.

R-S Valves show substantial savings in pumping power due to low pressure drop. Consider also the compact design, light weight and self-cleaning features.

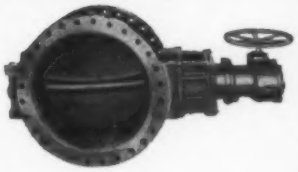
Consult with your local R-S representative. Look for the address and phone number listed under "R-S Products, Valves" or write direct.

R-S PRODUCTS CORPORATION
Wayne Junction • Philadelphia 44, Pa.

Sectional view shows beveled vane of R-S Valve firmly seated at a 12½° angle. A metal-to-metal seat gives satisfactory commercial shut-off in many cases. Manual or automatic control available.



Drip tight or bubble tight closure can be obtained with a rubber seat. Under pressure, due to the 12½° angle of closure, the rubber yields both radially and longitudinally around the shaft-bosses and the periphery of the valve vane to insure positive shut-off.

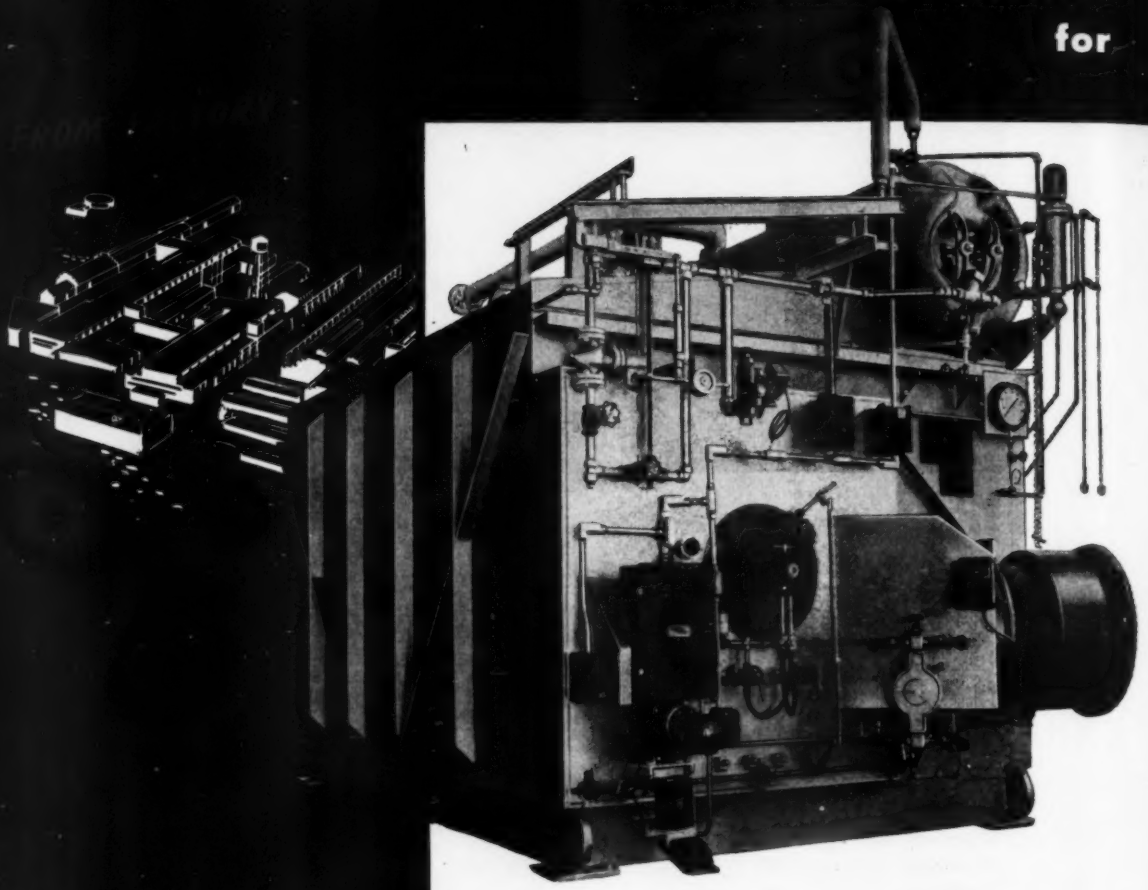


No. 709 30-inch 50-pound valve equipped with rubber seat. Air bubble tight at 80 psig and drip tight with water at 100 psig. Fully enclosed gear reduction drive. Every R-S Valve is available in smaller and larger sizes, in all materials and for lower and higher pressures.

New!

Catalog No. 18 featuring R-S 50-pound valves is just off the press. Ask for it!

Foster Wheeler Package for



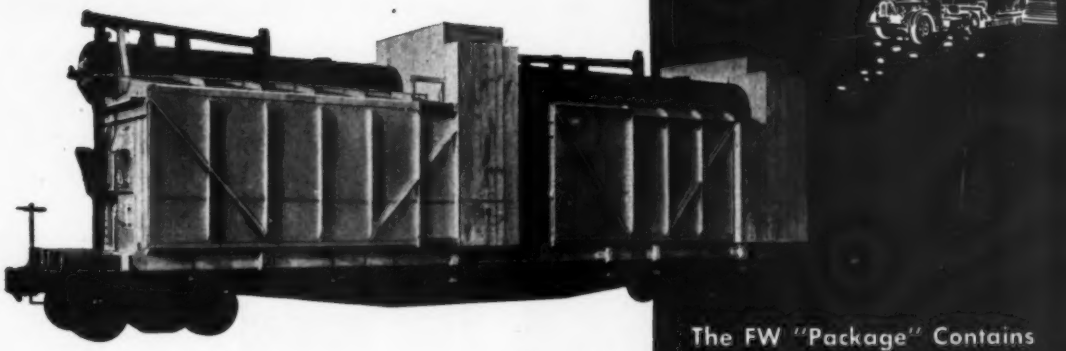
FACTORY ASSEMBLED STEAM PLANTS—Industry's need for small but efficient plants to supply power or process steam is fulfilled by Foster Wheeler *factory assembled water-tube steam generators* which can be shipped by common carrier, (truck, rail, or water) and readily installed. The labor necessary for installing a packaged unit is for the most part limited to service connections.

Foster Wheeler Package Steam Generators reflect the high engineering standards of an organization with over 50 years' experience in the art of steam generation and the manufacture and erection of power plant equipment. Therefore the purchaser of a Foster Wheeler Package Steam Generator is assured of skilled erection with proper assembly of any auxiliary equipment, high economy of steam production with any type of fuel, and efficient operation.

FOSTER WHEELER CORPORATION · 165 BROADWAY, NEW YORK 6, N. Y.

Units up to 35,000 lb per hr

Coal, Oil, or Gas Firing



Write for a copy of Bulletin PG-49-13b which contains drawings, sizes, and descriptions of Foster Wheeler Package Steam Generators.

The FW "Package" Contains

All These Features

Completely Factory Assembled.

Design pressures 300-500-900 psi.

Simplified water cooled furnace construction with low furnace temperatures.

Generous combustion chambers with low Btu release per cu ft of furnace volume for all types of fuel.

Positive natural circulation.

High thermal efficiency.

Choice of manual, semi-automatic or fully automatic controls.

Steel encased construction.

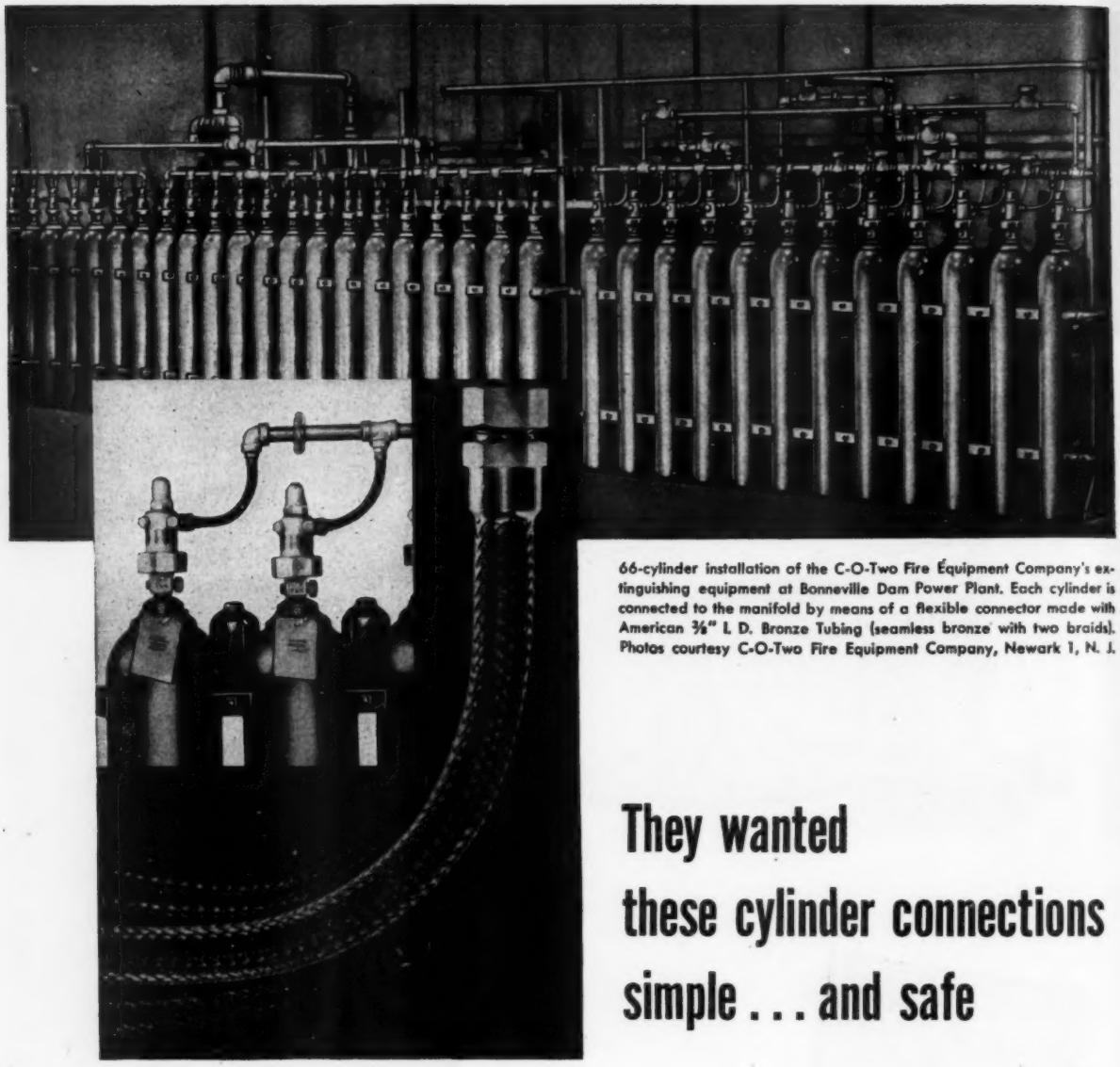
Drums with large volumes—manholes at both ends—factory-applied insulation.

Attractive exterior finish.

Minimum heat loss from radiation and air infiltration.

Sizes from 1500 to 35,000 lb per hr are plant assembled or field erected at customer's option.

Sizes from 40,000 to 50,000 are field erected only.



66-cylinder installation of the C-O-Two Fire Equipment Company's extinguishing equipment at Bonneville Dam Power Plant. Each cylinder is connected to the manifold by means of a flexible connector made with American ⅜" I. D. Bronze Tubing (seamless bronze with two braids). Photos courtesy C-O-Two Fire Equipment Company, Newark 1, N. J.

They wanted these cylinder connections simple . . . and safe

So they used American Seamless Flexible Metal Tubing for the 66 manifold connectors in this installation. Couplings swing freely and accurately into line. No struggling with rigid or semi-rigid pipe or tube.

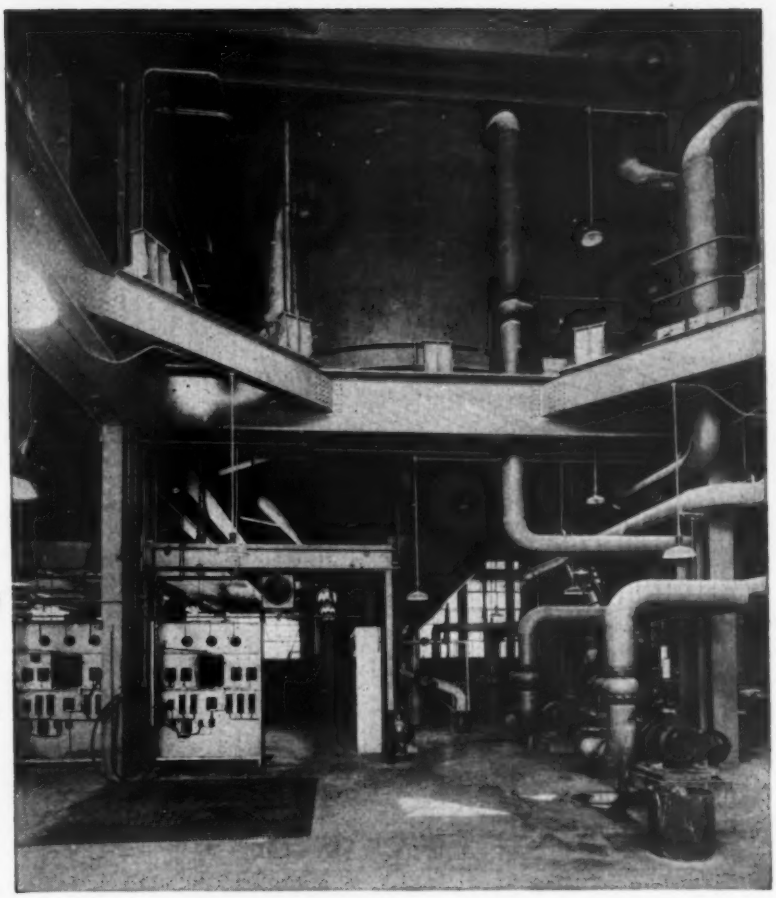
Resists corrosion, heat and cold; minimizes vibration. American Seamless Flexible Metal Tubing can be flexed thousands of times with no danger of failure—carries thousands of pounds pressure safely. For flexible metal hose or tubing designed for use with almost any gas, vapor, liquid, or even semi-solid, consult The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

ANACONDA
from mine to consumer

wherever connectors must move . . . ***American***

FLEXIBLE METAL HOSE AND TUBING

One of the two 85,000 gph GRAVER Hot Process Softeners installed at Indianapolis Power & Light Co. The photograph shows the lower portion of the sedimentation tank inside the building.



"Success Story" of GRAVER

Hot Process Water Softeners

This GRAVER "Success Story" took place at the Indianapolis Power & Light Co. Five Hot Process Softeners of another make were being used, but a more efficient central installation was desired. A single GRAVER unit was installed to replace the five existing older units. When the plant was later expanded, an additional GRAVER Softener was installed. These two GRAVER Hot Process Lime Soda Softeners have a combined capacity of 170,000 gph, and are treating feed water for boilers operating at 625 psig and 750°F.

The thorough effectiveness of this GRAVER installation is shown in the following results: The raw water hardness of 290 ppm is reduced to less than 15 ppm with excess soda ash of 25 ppm and causticity of approximately 10 ppm (all as $CaCO_3$). An effluent turbidity of less than 8 ppm results in minimum filter back-washing.

And here's another GRAVER advantage to remember. All major component parts of the Softeners were fabricated in the GRAVER shops, and the units were erected and initially operated by GRAVER, providing a single responsibility for the entire job.

A new GRAVER bulletin explaining the functions, principles and applications of Hot Process Softeners and the distinctive features of GRAVER designs is now available. You will find it particularly informative and helpful. Write for your copy today.

GW 408

GRAVER WATER CONDITIONING CO.

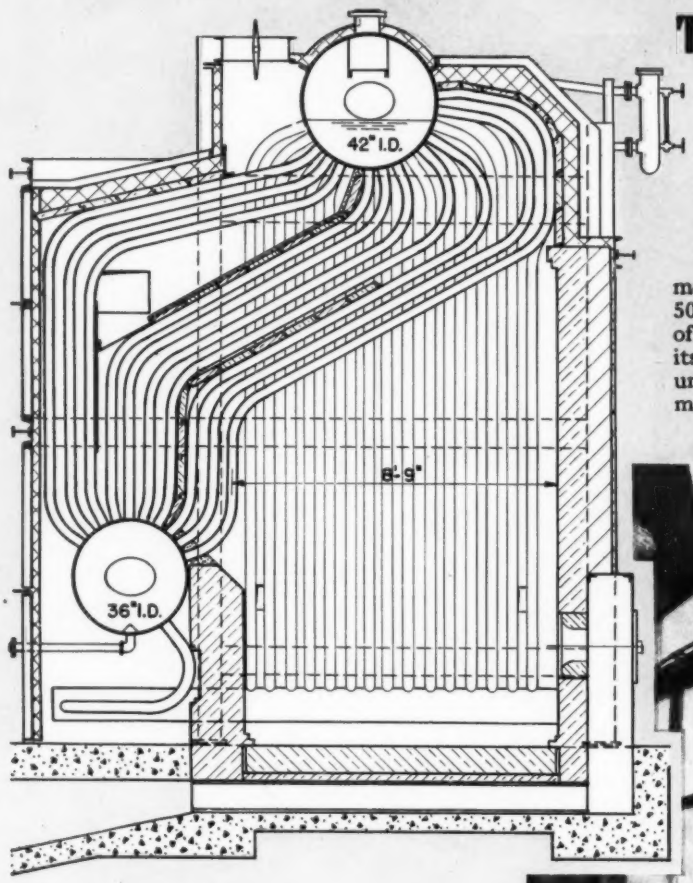
216 West 14th Street, New York 11, New York, U.S.A.

CHICAGO • PHILADELPHIA • CLEVELAND

GRAVER

A DIVISION OF GRAVER TANK & MFG. CO., INC. EAST CHICAGO, IND.

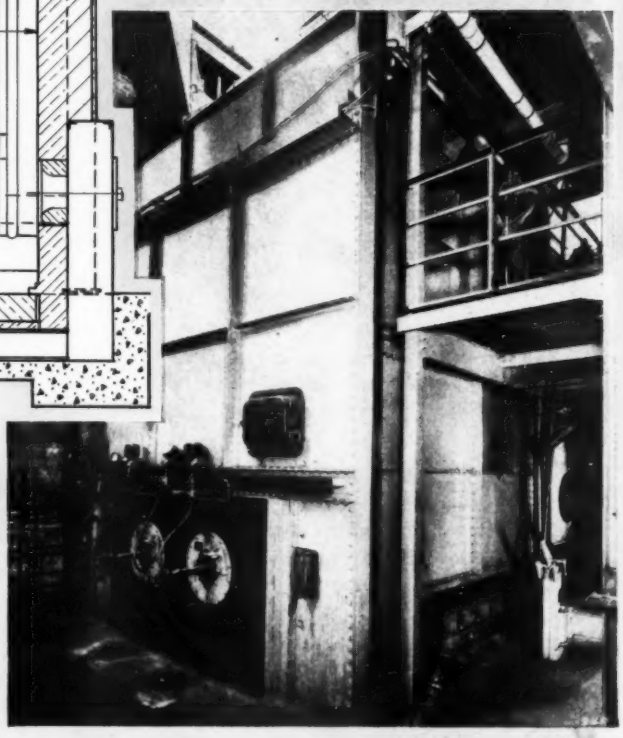
Efficient Boiler Unit for t



THE RILEY "RZ" BOILER UNIT

For capacities between 10,000 lbs. and 50,000 lbs. of steam per hour. Adaptable for spreader or underfeed stoker, oil or gas firing.

The Riley "RZ" boiler unit is an efficient modern unit for steam capacities up to 50,000 pounds per hour. While economics of standardization are taken advantage of, its design is sufficiently flexible to provide a unit best suited for the particular requirements of the plant involved.



WORCESTER POLYTECHNIC INSTITUTE
Worcester, Mass.

20,000 lbs./hr. Oil fired
Riley "RZ" Boiler Unit

Photograph of Riley "RZ" Boiler Unit at Worcester Tech.

Note the rugged steel-clad insulated setting assuring permanent tightness.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

the Moderate Sized Plant

THE RILEY "RZ" BOILER UNIT

Rapid Positive Circulation

The design of the Riley "RZ" boiler is based on the ring flow principle of circulation which together with the large height difference between drums assures unusually rapid and positive circulation.

High Efficiency

The design of the Riley "RZ" boiler results in efficient heat transfer from the gases to the boiler water, assuring high efficiency.

Side Walls Water Cooled

Side walls are water cooled to provide large radiant heat absorbing surfaces, to protect side wall refractories and to minimize slagging difficulties.

Steel Clad Insulated Setting

To assure low heat loss by radiation, to eliminate air and gas leakage, and to reduce setting maintenance, a heavily insulated steel clad setting is provided. The rugged steel casing, No. 10 gage flanged panels, not only provides permanent tightness but is sufficiently strong to prevent damage to the setting in case of severe furnace puffs.

Reliability and Low Maintenance

Because of rapid positive circulation and the substantial setting construction, low maintenance and long periods of uninterrupted service are assured.

One Contract—Undivided Responsibility

Riley manufactures all types of fuel burning as well as steam generating equipment so that the complete unit can be purchased from Riley with undivided responsibility. The proper co-ordination of boiler and fuel burning equipment is assured.

Riley "RZ" boilers are constructed and designed to the same high standards as are large Riley central station units.

All of these well-known companies have purchased Riley boiler units of steam capacities under 50,000 lbs/hr.

SCHUTTE & KOERTING CO.
U. S. VANADIUM CORP.
BROWN & WILLIAMSON TOBACCO CO.
CLUETT PEABODY & CO.
HART SCHAFFNER & MARX

KENNECOTT COPPER CO.
SHERWIN WILLIAMS CO.
CLARK EQUIPMENT CO.
NUNN BUSH SHOE CO.
U. S. GYPSUM CO.

GENERAL TIME INSTRUMENT CO.
SWIFT & COMPANY
CELANESE CORP. OF AMERICA
CONGOLEUM NAIRN, INC.
NICHOLSON FILE CO.

BOEING AIRCRAFT CORP.
SCOVILL MFG. CO.
GENERAL MOTORS CORP.
GENERAL FOODS CORP.
PULLMAN STANDARD CAR MFG. CO.

MONSANTO CHEMICAL CO.
THE BULLARD CO.
GENERAL ELECTRIC CO.
EAGLE PICHER LEAD CO.
MODINE MFG. CO.

While Riley has installed some of the largest boiler units in the country, a large portion of their sales are for units under 50,000 lbs. of steam per hour.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your [illegible] costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD [illegible] AIR HEATERS

Free Yourself

from Constant Repair and Replacement Troubles with the

Chapman LIST 960

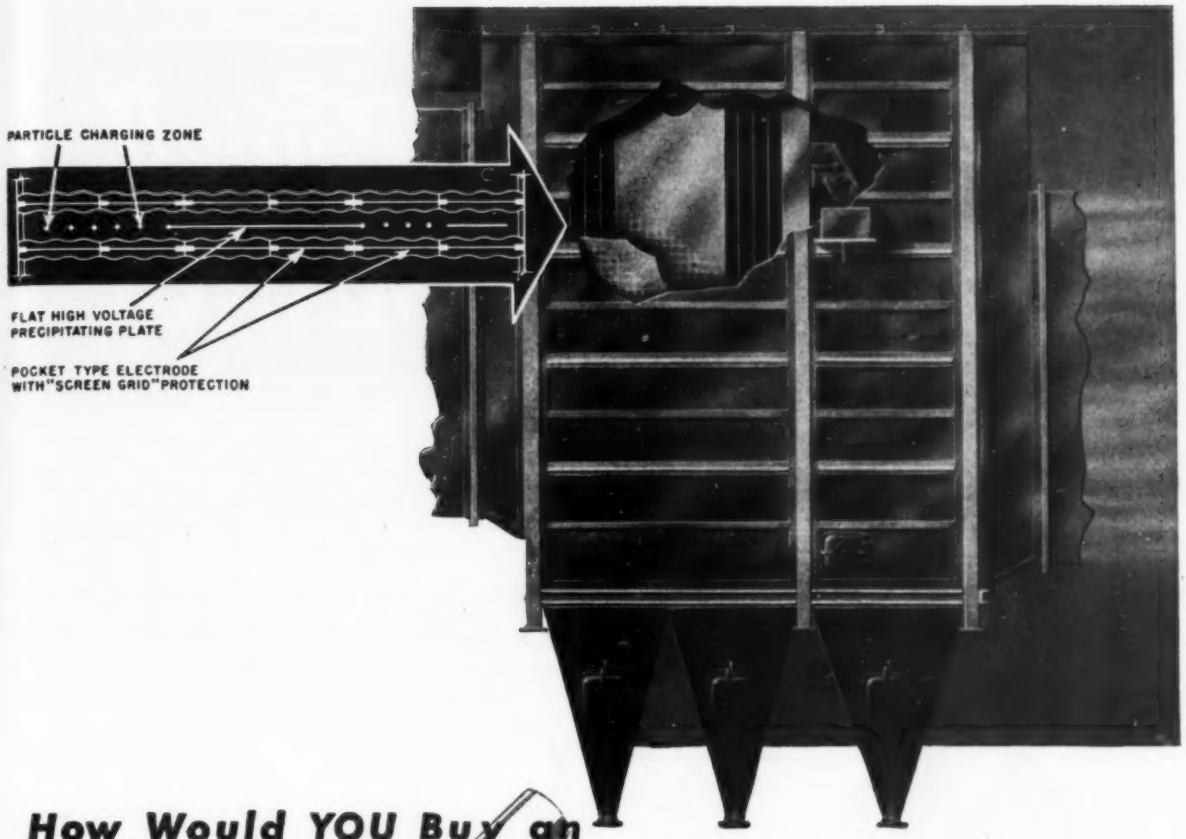
...the long lasting Gate Valve!

Unlike ordinary valves, the Chapman 960 is extra-sturdy to give you longer trouble-free service. And here's why —

1. Body and yoke are made of tougher forged steel.
2. A flanged, forged-steel packing gland protects threads on valve yoke from rust and corrosion.
3. No gaskets to blow.
4. Repack it under full pressure — no pressure transmitted to valve stem.
5. Newly designed stem and wedge gate connection gives 50% increase in strength at points where extreme stress can develop.
6. Malcomized stainless steel seat rings and wedge faces ensure maximum wear resistance.

So for your best buy specify the Chapman List 960. Available in sizes from ¼" to 2" — carbon steel for pressure range 2000 pounds at 100° F., 380 pounds at 1000° F. For higher pressures, specify List 990.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS



How Would YOU Buy an

ELECTRICAL PRECIPITATOR?

The basic elements of all electrical precipitator units are fundamental. All require a shell or casing with an inlet and outlet, the charging electrodes, precipitating or collecting electrodes, some form of rapping device, and a high voltage power supply.

The design of these elements, however . . . and their application to the process of electrical precipitation, is the governing factor between mediocrity and startling success.

It is highly important then, that the specifying engineer thoroughly investigate the refinements and latest developments on these basic elements and their overall effect on operating efficiency of the precipitator he is considering.

An investigation will indicate that the Aerotec Electrical Precipitator is far advanced in the four basic steps of precipitation:

1. Charging the particle.
2. Forcing charged particle to collecting electrodes.
3. Releasing the electrical charge.
4. Deposition in storage hopper.

Aerotec high voltage electrodes are subdivided for maximum effectiveness in charging and precipitating functions. Highest precipitating force is developed between flat plates, which provide a uniform field of high intensity.

To reduce the possibility of reentrainment of particles in the gas stream, Aerotec has developed a new "pocket type" collecting electrode. This unique design insures a dead zone surrounding the electrodes for maximum efficiency on both coarse and fine dusts. Release of carbon particles by induced charge, and loss of performance due to "backionization" are reduced to a minimum by this exclusive Aerotec design. Alternate rapping of the collecting electrodes reduces emission and minimizes stack "puffing" during rapping periods.

The Aerotec electrical precipitator is an ideal secondary for the Aerotec Mechanical Design 3 RAS, a combination that assures the highest efficiency possible in dust collection . . . an efficiency that will meet the most stringent dust requirements of today . . . and tomorrow.

AEROTEC

Project & Sales Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(Offices in 28 principal cities)

Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St., W., Montreal 25, Quebec

THE AEROTEC CORPORATION

GREENWICH, CONNECTICUT

The ABC's of Powell Valve PERFORMANCE

Fig. 1303 W. E.—Class 1500-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge.

Fig. 1333-A — Class 1500-pound Steel Integral Bonnet Angle Valve with welding ends. Also available in Globe and "Y" patterns.

Always the right valve. And, because Powell *can* always furnish the *right* valve, you can avoid failures that result from trying to make a valve "do" in a service to which it is not *specifically* adapted, as well as those caused by misapplication.

Built to last. Powell Valves are designed for long life at a minimum cost of maintenance. The cost of construction and materials of any Powell Valve is determined solely by the requirements of the service for which the valve is designed.

Complete Line. Powell Valves are made in all types such as Globe, Angle, "Y", Gate, Check, Non-return and Flush Bottom Tank. Materials include not only Bronze, Iron and Steel but also a wide range of Corrosion-Resistant metals and alloys.

Ask your nearest Distributor—or write direct

Fig. 241 — Large 125-pound Iron Body Bronze Mounted Globe Valve. Made in sizes 2" to 16", incl. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

Fig. 500 — 125-pound Bronze Gate Valve with screwed ends, screwed-in bonnet, inside screw rising stem and tapered wedge: solid in sizes ¼" to ¾"; double in sizes 1" to 3".

Fig. 3031 W. E. — Class 300-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

The Wm. Powell Company
Cincinnati 22, Ohio
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES

The most resounding compliment an operating man can pay a sales engineer is contained in those simple words. When you say "he knows his way around" you mean in no uncertain terms that someone has gotten right down to business and wiped out one of your problems.

Those words are the sweetest music that comes to our ears when we go into a plant and show an operating man the straight, low-cost route to a complete solution of his water conditioning problem. Thousands have said it of the Elgin organization; you will say it too . . . and we'll tell you why:

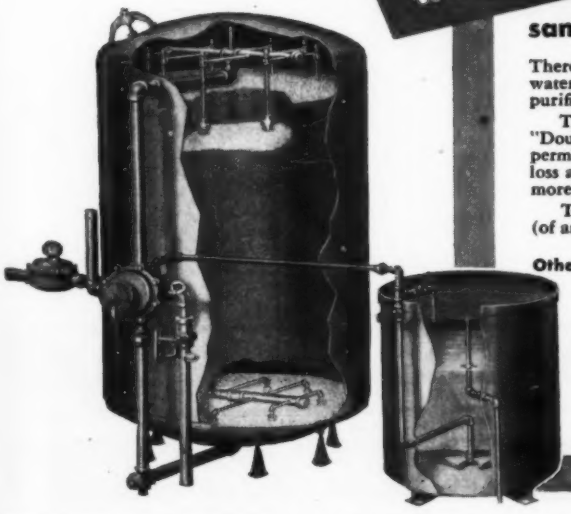
Elgin knows its way around because we have tusseled with just about every conceivable water conditioning problem . . . because we have explored every method that can be properly applied to any problem . . . because we have available every authoritative method.

Unlike the man who deals with only one or two methods, the Elgin man can select the *best* method from all methods. That's why he can choose the method that fits your condition, instead of trying to convince you that your condition fits *his* method!

There is no cost or obligation whatever for a complete check-up of your conditions and a concrete recommendation from the organization that is so widely acknowledged to know its way around. Write today for facts about an Elgin survey.

ELGIN SOFTENER CORPORATION
138 N. Grove Ave., Elgin, Ill.

ELGIN
ECONOMICAL WATER CONDITIONING



Up to 44% more soft water per regeneration—from the same size softener using same type of zeolite

There you have the proof that Elgin knows its way around in the zeolite water softening field, just as in the fields of chemical treatments, filters, purifiers, and other water conditioning methods and equipment.

The open secret of this greater, zero-soft water output is the Elgin "Double-Check" manifold design which prevents escape of zeolite; thus permits using more zeolite in a tank of given size. Prevention of zeolite loss also permits faster, more thorough back-washing. Over-all result is more soft water, from a smaller softener, at lower cost.

The "Double-Check" system can also be installed in existing softeners (of any make) with these same remarkable results.

Other Elgin water conditioning methods and equipment include:

- Boiler feed water treatments
- Post treatments for softened water
- Corrosion prevention in steam systems
- Corrosion prevention in hot and cold water piping
- Filters and purifiers
- Boiler sludge removal (Deconcentrator) systems
- Iron removal equipment
- Aerators and Degasitors
- Chemical feeders
- Water testing equipment
- Zeolites of all types

Here's How to Erase Smoke Troubles

VIOLATION OF SMOKE ORDINANCE

LOSS OF FUEL ECONOMY

BAD COMMUNITY RELATIONS

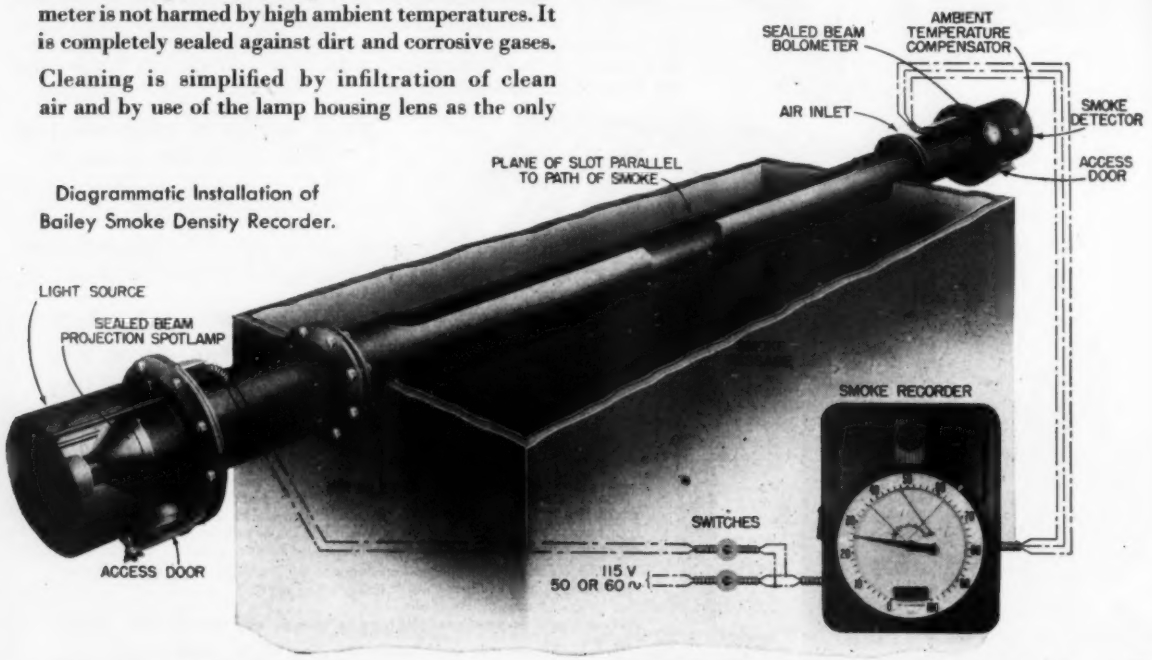
★ One of your first steps in erasing these troubles which result from excessive smoke, should be the installation of a Bailey Smoke Density Recorder. This 24-hour recorder is not an ordinary photo-cell instrument. Instead it detects smoke density by a Bolometer which is simply a sturdy tungsten filament and a parabolic mirror, mounted in a standard sealed beam automobile head lamp housing.

In using this simple, unique smoke detector, you do not have to provide cooling devices since the Bolometer is not harmed by high ambient temperatures. It is completely sealed against dirt and corrosive gases.

Cleaning is simplified by infiltration of clean air and by use of the lamp housing lens as the only window between the Bolometer and the gas passage.

It's easy to secure and maintain alignment of the sealed beam light source with the Bolometer since they are mounted at opposite ends of a slotted pipe which extends across the smoke passage.

For complete information on how you can profitably use this unique instrument to erase your smoke troubles, ask for Bulletin 211, "Bailey Smoke Density Recorder".



Diagrammatic Installation of Bailey Smoke Density Recorder.

G-29

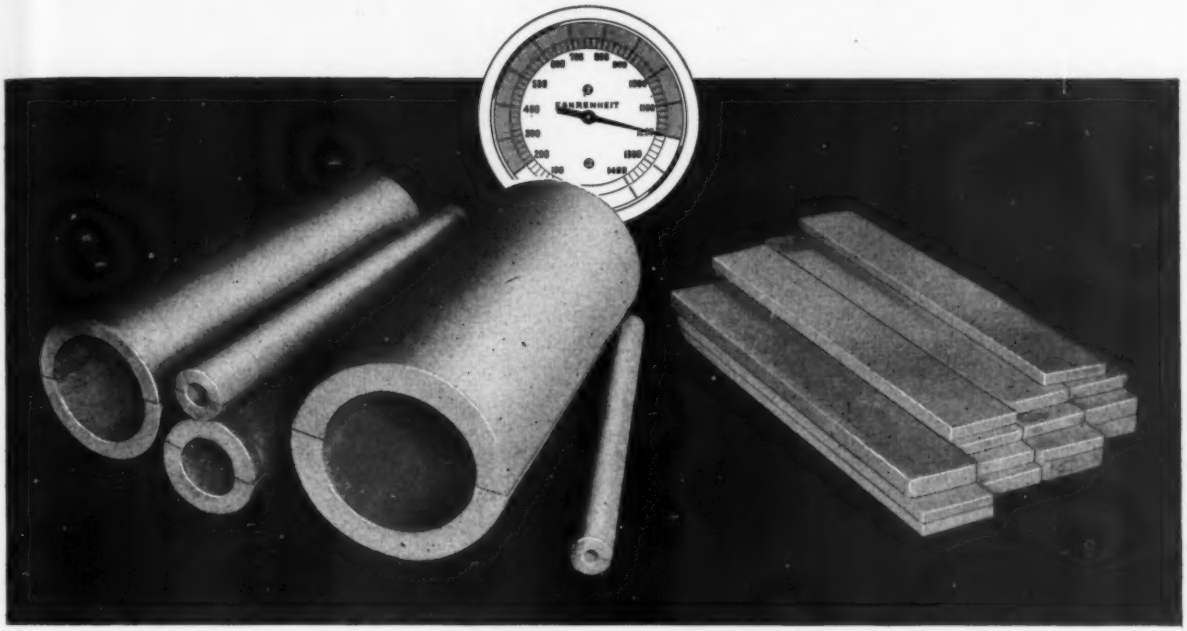
BAILEY METER COMPANY

1038 IVANHOE ROAD, CLEVELAND 10, OHIO • BRANCH OFFICES IN PRINCIPAL CITIES

BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

Let Bailey Smoke Density Recorders Watch Your Stacks

ONE MATERIAL INSULATES A 200°F.-1200°F. TEMPERATURE RANGE



KAYLO HEAT INSULATING BLOCK can be easily sawed, cut and scored with standard tools. Cement, canvas or other outer finishes can be applied with minimum effort. Finished jobs have a neat, clean appearance.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary. Available in thicknesses from 1 to 3 inches in 36-in. sections for pipe sizes from ½ inch to 12 inches.

Every engineer concerned with insulation problems should know about Kaylo Heat Insulating Block and Pipe Insulation. No other insulation provides such a combination of advantages.

Available in block or pipe covering form, this material is remarkably efficient throughout a wide 200°-1200°F. temperature range. It is strong and resistant to effects of moisture for long service. It is lightweight, easy to handle and apply.

Many types of industries have found this material ideal for their insulating needs. Get the facts now about Kaylo Heat Insulating Block and Kaylo Pipe Insulation.

KAYLO®

HEAT INSULATING BLOCK and PIPE COVERING

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division Toledo 1, Ohio

SALES OFFICES AT:

Atlanta	Boston	Buffalo	Chicago	Cincinnati
Dallas	Minneapolis	New York	Philadelphia	Pittsburgh
	St. Louis	Toledo	Washington	

MAIL COUPON FOR KAYLO INSULATION SAMPLES AND LITERATURE

Owens-Illinois Glass Company
— Kaylo Division Dept. N-76, Toledo 1, Ohio

Gentlemen: Please send me Kaylo heat insulation samples and descriptive literature.

NAME.....

FIRM.....

ADDRESS.....

CITY..... STATE.....

NO, SIR!
The Seal Won't Blow!

METALLIC-BACKED neoprene seals are used in this famous bearing — and they are engineered to *stay put.* They can't blow.

Your lubricant stays in; dust and dirt stay out; the result is years and years of trouble-free performance.

The "SC" Bearing is a new member of the Dodge 30,000 hour line. Modern styling. Rugged one-piece cast iron housing. Long inner race. Radial and thrust load capacity. Fully self aligning. *WRITE* for special "SC" bulletin, giving complete specifications.

DODGE MANUFACTURING CORPORATION, 700 Union St., Mishawaka, Ind.

DODGE TYPE "SC" BALL BEARING PILLOW BLOCK

Precision built bearing for small shafts and moderate loads. Pillow blocks, flange bearings and hanger bearings available from distributors' stocks in shaft sizes ranging from 3/4" to 2-7/16".

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained, he can give you valuable assistance on new, cost saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE
of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

EXCLUSIVE DOUBLE ACTION PRINCIPLE GUARANTEES BOTH CLEAN AND DRY AIR

1. MECHANICAL SEPARATION

Deflector cup directs flow of air or gas together with water, oil and dirt to the walls of the housing and thence downward at high velocity into the base where liquid and heavier dirt particles are deposited.

2. FILTRATION

Air or gas, having been mechanically cleaned, rises at low velocity through the Radial Fin Filtering element or insert which removes the lighter airborne material.

The popularity of Staynew Double Action Pipe Line Filters increases as manufacturing tolerances decrease—as vanes and pistons are closer fitted, orifices are made smaller, machines in general are built to more precise limits and processes are more scientifically controlled. Inexpensive, quickly installed and easily maintained, these filters provide highest filter efficiency with low overall maintenance.

IMPORTANT APPLICATIONS

Protection of Air-operated Tools ★ Paint Spray ★ Sand Blast ★ Air Displacement of Liquids ★ Air-operated Instrument Controls Liquid Agitation

COMPLETE DATA ON REQUEST

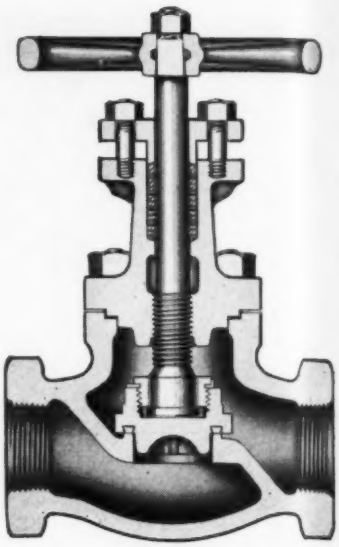
DOLLINGER CORPORATION

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

46 CENTRE PARK ROCHESTER 3, N. Y. REPRESENTATIVES IN PRINCIPAL CITIES

MORE THAN 1,000,000 STAYNEW PIPE LINE FILTERS SOLD TO INDUSTRY

ALL PIPING EQUIPMENT YOU NEED ...FROM ONE SOURCE OF SUPPLY



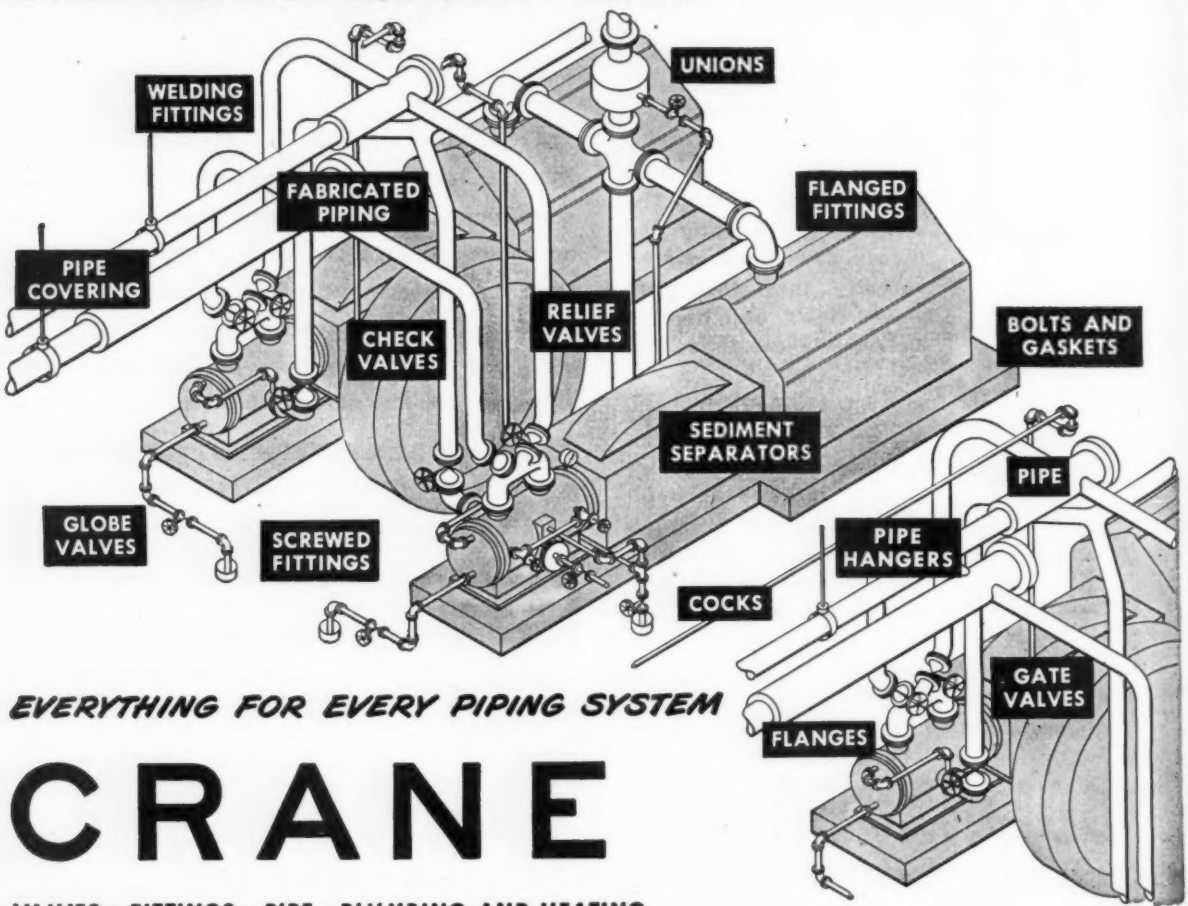
WORKING PRESSURES:
300 pounds ammonia;
500 pounds oil, gas, or air up to 100° F.
Sizes: ¼ to 3 in.; Screwed or flanged ends.

SAFER CONTROL FOR MANY SERVICES, Crane Ferrosteel Globe and Angle Valves—especially designed for high pressure ammonia refrigeration service—also find wide application on air, gas, oil and chemical lines where heavy, all-iron construction is desired. Special Crane seating design, rugged construction, and precise manufacture combine to make these valves safer, more efficient on all heavy duty services.

For volatile and hazardous fluids, these valves are supplied with a lead face disc specially designed for tight seating. For high temperatures and certain corrosive conditions, a case-hardened steel disc and seat can be supplied. Available with tongue and groove flanged ends, or screwed ends with extra long threads, and recessed for soldering. See your new No. 49 Crane Catalog, p. 394-5.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

THIS AMMONIA COMPRESSOR INSTALLATION, FOR EXAMPLE, CAN BE COMPLETELY EQUIPPED BY CRANE



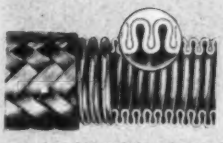
EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

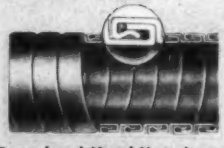
VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

CMH

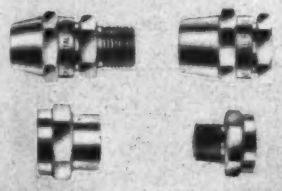
One dependable source for every flexible metal hose requirement



Corrugated Metal Hose in steel, bronze and stainless steel.



Convoluted Metal Hose in variety of types—steel, bronze and alloys.

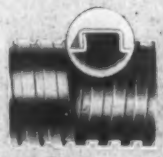


Couplings to meet every need.

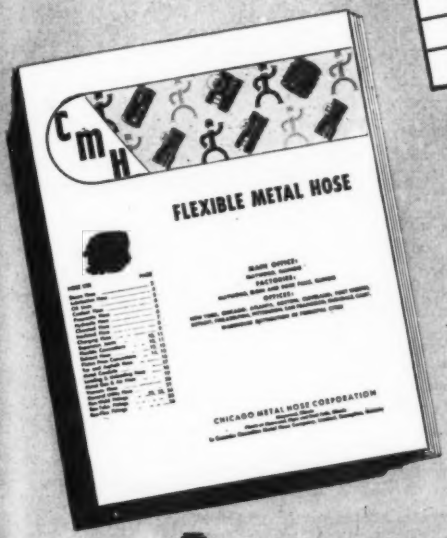
CMH	HOSE USE
✓	Steam Hose
✓	Lubrication Hose
✓	Oil Lines
✓	Coolant Hose
✓	Pneumatic Hose
✓	Hydraulic Hose
✓	Chemical Hose
✓	Insulated Hose
✓	Charging Hose
✓	Expansion Joints
✓	Flexible Connections
✓	Exhaust Hose
✓	Platen Press Connections
✓	Tar and Asphalt Hose
✓	Metal Conduits
✓	Loading & Unloading Hose
✓	Gas & Air Hose
✓	Vacuum Hose
✓	General Utility Hose
✓	Bellows
✓	Flexible Lamp Arms

Expansion Joints for high and low pressures—stainless steel and copper.

Bellows in all sizes for all requirements—stainless steel and brass.



Metal Conduits in a variety of types and materials.



Now you can secure all your flexible metal hose needs from a single manufacturer. The handy check list above indicates only the more common types and assemblies manufactured by CMH. Other types and assemblies are also available. Bulletin 102, illustrated at the left, an application guide for CMH Flexible Metal Hose is available on request. Other literature giving full details on expansion joints, bellows and speciality items is also available. Write for your copies of the material in which you are interested and have it available for reference at all times.

Flexon identifies CMH products which have served industry for more than 47 years.

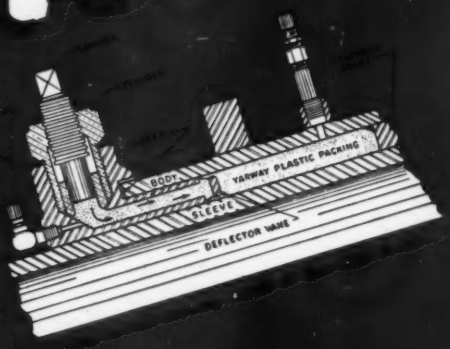
CHICAGO METAL HOSE CORPORATION

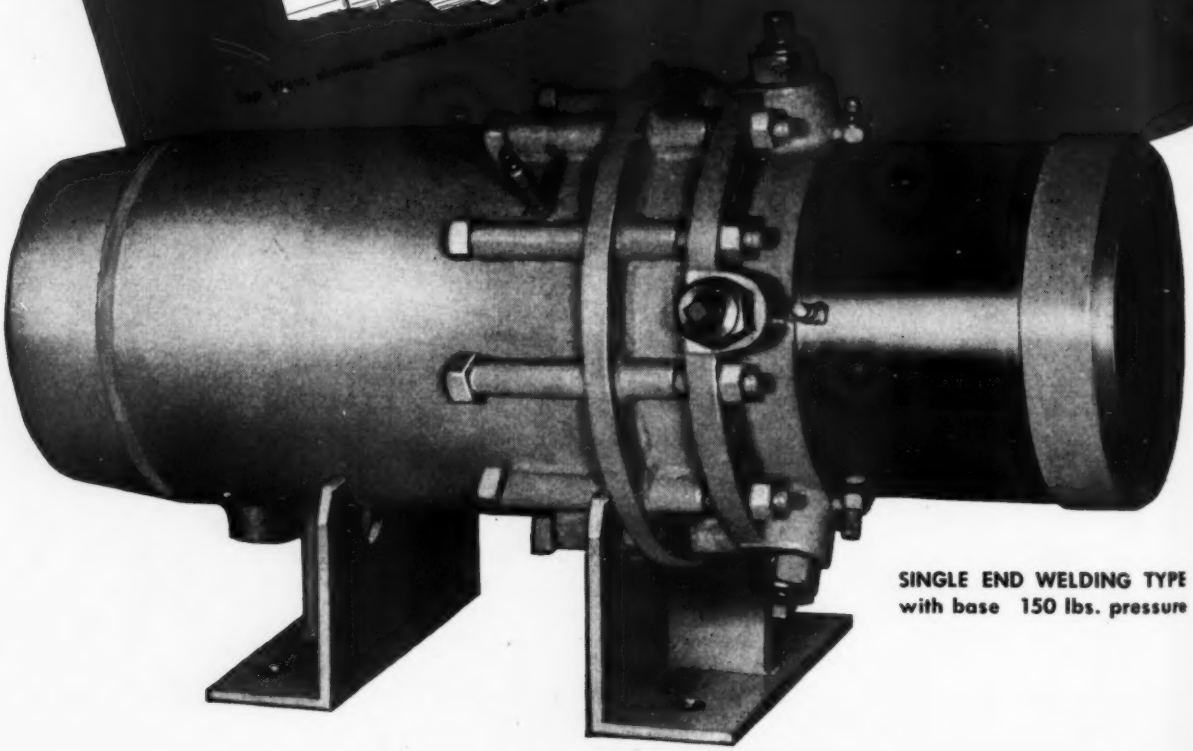
Maywood, Illinois

Plants at Maywood, Elgin and Rock Falls, Illinois

In Canada: Canadian Metal Hose Company, Ltd., Brampton, Ontario

SAVE LABOR WITH GUN-PAKT





SINGLE END WELDING TYPE
with base 150 lbs. pressure

YARWAY

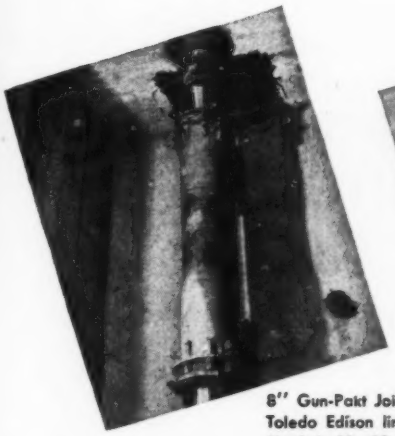
TOLEDO EDISON CHOOSES THE EXPANSION JOINT THAT IS *Serviced* UNDER FULL STEAM PRESSURE

Toledo Edison Company knows how to save on expansion joint maintenance. They use Yarway GUN-PAKT Joints—22 of them, ranging in size from 8″ to 14″ on their recent steam distribution extension.

GUN-PAKT Joints are serviced under full steam pressure . . . no costly shutdowns or heating interruptions. For repacking, simply insert a packing plug, twist a wrench, and the job's done! Special Alemite fittings provide for proper lubrication. Maintenance costs are low. One user says only 65 cents per year per joint. Others claim less than that. But wherever steam is distributed, and expansion joints are used, the trend is toward GUN-PAKT.

Read the GUN-PAKT story in Yarway's Bulletin EJ-1912. Write—

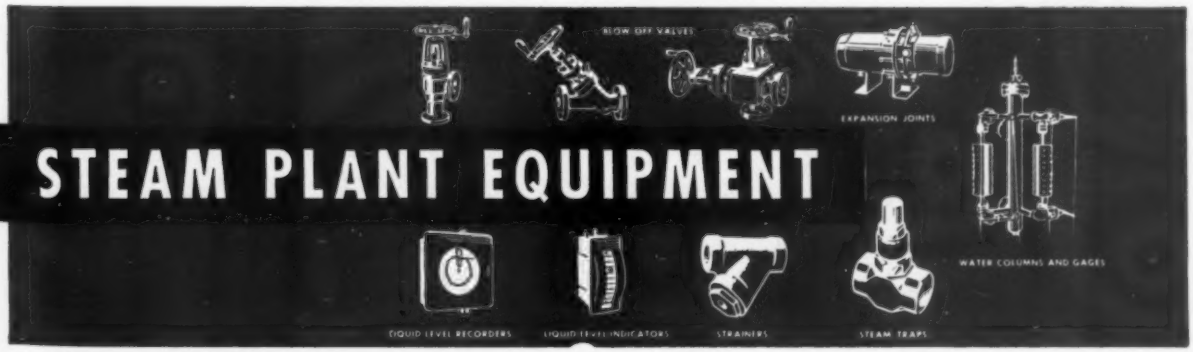
YARNALL-WARING COMPANY
109 Mermaid Ave., Philadelphia 18, Pa.



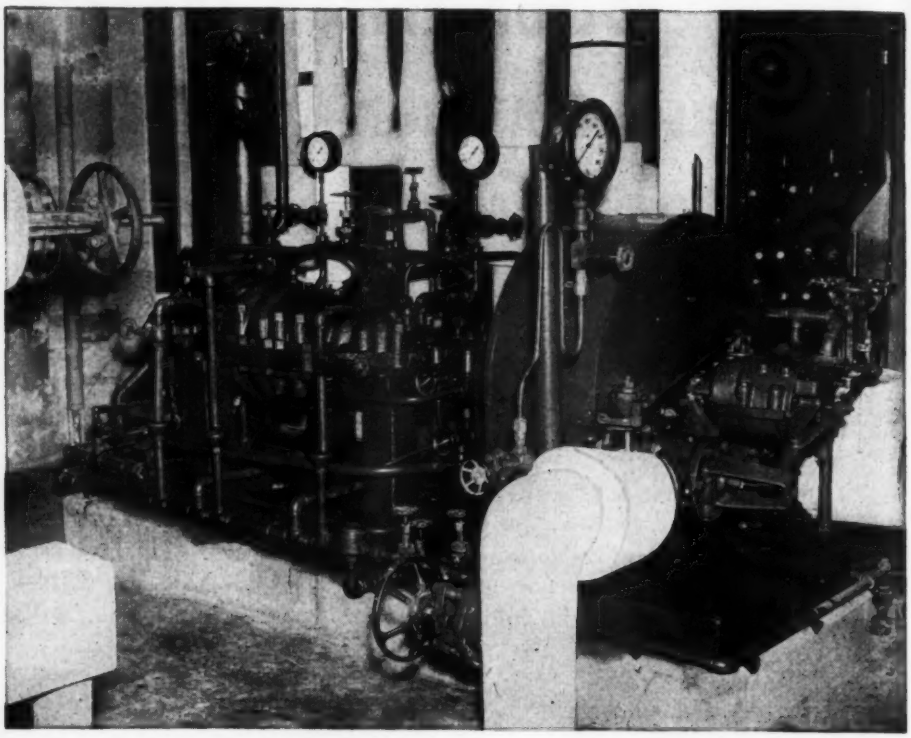
8″ Gun-Pakt Joint on Toledo Edison line at Manhole No. 12.

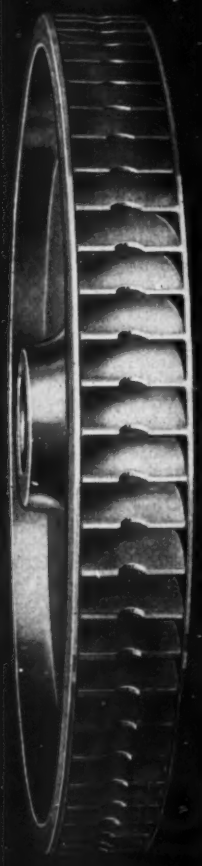
Yarway Gun-Pakt Joint on Toledo Edison Jackson Avenue line.

14″ Gun-Pakt Joint in Toledo Edison No. 1 Manhole.



TERRY





Large Turbine Clearances for DEPENDABILITY *In Desuperheat Control*

In the design of this topping plant emphasis was placed on dependability and continuity of service.

An important feature is pressure reducing and desuperheating 1250 psi, 900 F steam to 400 psi, 600 F, at various rates to meet low-pressure steam and power demands.

For this service the 100 hp Terry Solid-Wheel Turbine, shown above driving a desuperheating water pump, is ideal. It has large radial and axial clearances and protective rims at the sides of the wheel. The blades cannot foul, end play can do no damage.

A descriptive bulletin on this dependable turbine will be sent upon request.

T-1180

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Gruelling tests... *an essential part of every* LUNKENHEIMER VALVE!

RIGID TESTING, far above the usual practice, is regular procedure in the production of Lunkenheimer Valves. From selection of raw materials to final assembly, nothing is left to chance or guess. Each and every operation is gauged to meet the high quality standards which assure dependable performance, longer service life and minimum upkeep.

In gate valves, for example, a Lunkenheimer final test means that *every* valve is tested on both sides, at high and low pressure for seat tightness and then given a careful shell test. Spot testing is not tolerated.

This may be producing valves the "hard way", but for Lunkenheimer, it's the only way since it safeguards our proudest possession . . . the mark of unswerving quality and dependability.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

Fig. 2150

150 lb. S.P. Bronze Gate

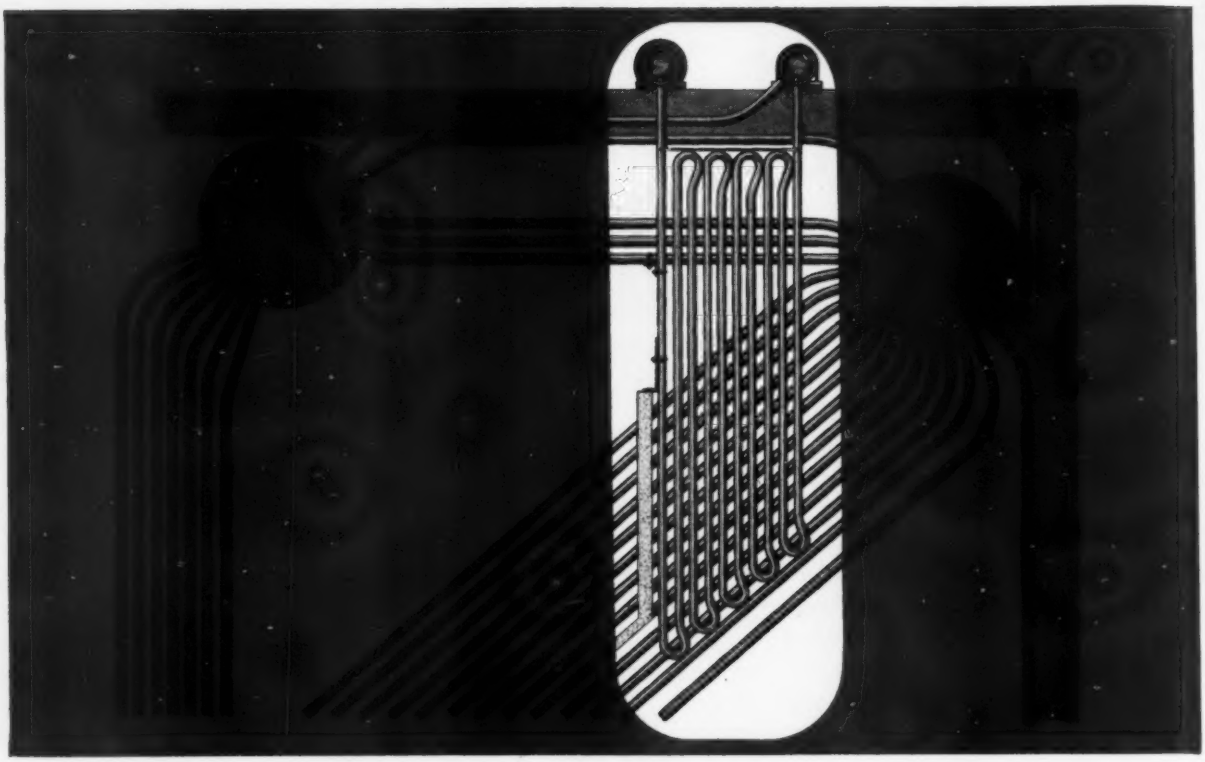
Like three valves in one. Number 2150 Double Disc, or Number 2151 Solid Wedge Disc, Rising Stem; or Number 2153 Single Wedge Disc, Non-rising Stem. How to convert one type to another by a simple interchange of trimmings is fully explained in Circular Number 574 available from your Lunkenheimer Distributor or direct.

Continually improved testing equipment, together with superior metallurgy and the most modern production equipment assures longer and trouble-free operation, making Lunkenheimer Valves cost less per year of service.

Another assurance of better valve service

In the event of valve trouble, you need and can depend upon, quick service from your Lunkenheimer Distributor. His stocks and facilities shorten production tie-ups, save you dollars and hours. Whether it's an emergency, routine maintenance or new installations, phone your Lunkenheimer Distributor for fast, dependable service.

Leadership through Achievement!



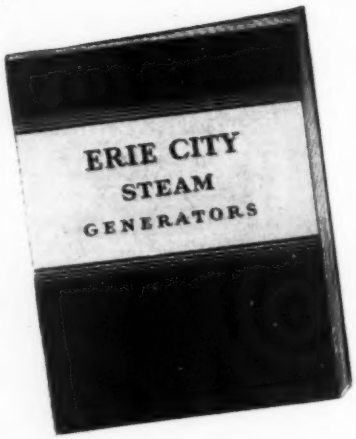
THE ERIE CITY SUPERHEATER

The illustration above shows one of the many types of superheaters designed and produced by Erie City to meet the exacting requirements of the modern steam generator. This particular example is the vertical pendant type.

The horizontal steam take-off serves also as the superheater inlet header, thus making the superheater an integral part of the boiler and simplifying installation and maintenance.

This familiar method of taking steam from an Erie City boiler in a transverse series of tubes, instead of a single nozzle, produces steam with high initial dryness and allows the superheater to perform with maximum efficiency and safety.

Our Steam Generator Bulletin (SB-30) illustrates and describes many types of superheaters engineered and manufactured within our own plant. It is available on request.



COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

INDUSTRIAL POWER

February, 1950 Vol. 58, No. 2

THE AMERICAN WAY OF LIFE

by JOHN M. HANCOCK

LET me try to describe our free enterprise system as it appears to me. It is a philosophy, a faith, a thing of the spirit and soul of America. It is not the product of a brain-truster, or of men who have made failures of their lives. It represents the striving of our people and the evolutionary development of the last thousand years. It is an entirely practical idea, for it has worked in America. It produced a standard of living and a national prosperity not even approached elsewhere in the world. While it can be improved, we should not be constantly on the defensive and we should not waste all our time apologizing for the minor weaknesses of the American system.

Meaning

The American Way of Life has prospered in the idea that "man is both too weak to wield unlimited power and, thank God, too strong to submit to it". No one has found "ringing words" for expressing the ideas wrapped up in the concept of the American Way of Life, but to me it certainly means all these ideas—equal opportunity for all, personal liberty consistent with full personal responsibility, no leaning on a beneficent or a bankrupt government (the only difference being one of time), no coercion by any one, no favors or benefits by government to one class of its people because of political pressures or with the purpose of gaining votes, no interference with the economic life of the nation, except when clearly in keeping with the national interest—the interests of all the people—no robbing one group for giving to another, or, in even simpler terms, it means the Golden Rule and the Sermon on the Mount.

It is a system based on the idea of a "fair field and no favors", a "profit and loss" system in which the citizen backs his own judgment with his efforts. If the two combine to produce a result pleasing to the public, the citizen gets his rightful reward. On the other hand, if he doesn't do what the public wants, he pays for his own mistakes. This American Way does not expect to have the mistakes of management buried in a federal budget of 40-odd billion dollars. It is a system of rigid discipline which develops a sense of responsibility, for it provides an adequate incentive for a wise effort and adequate penalty for an unwise undertaking. It is all these and more, too, but these seem the essential elements.

The time has now come, however, for us to organize our thinking around ways and means of strengthening our economy, of knowing what we want to do with it, how we want to operate, and why we want it to continue. We cannot win this objective merely by making or listening to addresses, making or seeking motion pictures about free enterprise, or by publishing or reading newspaper advertisements about it. We can win it only by personally working over it, discussing issues, analyzing them in relation to the common good, and spreading the results of this work to others.

Obligation

I think that every man in business owes the obligation to his own conscience, his own company, and his own community, to understand the common sense of this situation and to explain it in its simplest terms. We need to spread a knowledge of economic facts and how our free economy works, and we should start with the workers in our own businesses. The need is great, if we are to retain our free system.

HEAT RATE 9200 BTU/KHW AT SCHILLER MERCURY STATION

First completely integrated mercury unit plant consists of two 7500 kw mercury turbine-generators and one 25,000 kw steam turbine generator. Oil now burned but station designed to use either coal or oil at about equal high efficiency.

HAROLD N. HACKETT
Construction Engineering Division, General Electric Company

DESCRIBED as the most efficient power plant of its size in the world, the Schiller station of the Public Service Co. of New Hampshire, Portsmouth, N. H., is the first installation of a mercury plant designed and built as a complete power generating unit. Major equipment includes two standard design 7500 kw mercury units and one 25,000 kw steam turbine generator set, which are co-ordinated in design and rating and have a total rated capacity of 40,000 kw.

Fuels

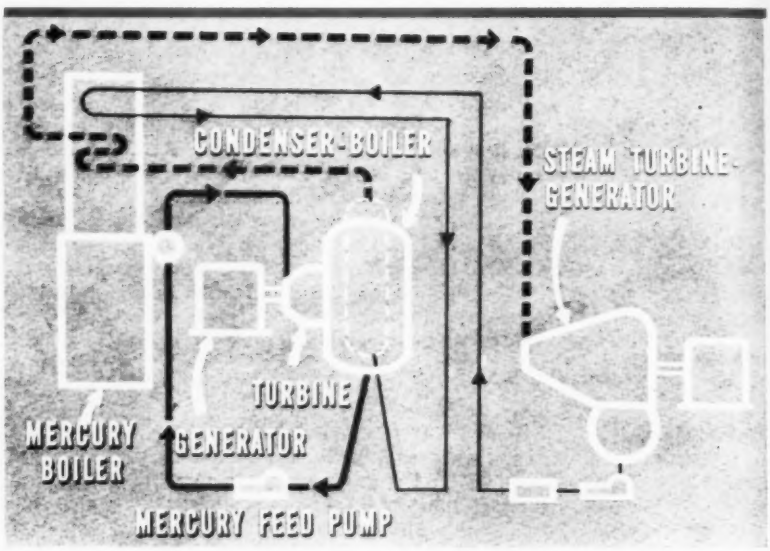
Since the plant heat balance was set up on two bases—one when the plant is burning Bunker "C" fuel oil and the second when the plant is operating with pulverized eastern bituminous coal—the station's gross generation is expected to be the same when operating with either fuel. However, the final net send-out per hour will be slightly less with coal firing, because of the additional power requirements of the coal preparation and other auxiliary equipment. The station net heat rate is lower when burning fuel oil as the result of lower auxiliary power requirements and higher boiler efficiency. When the station is operating

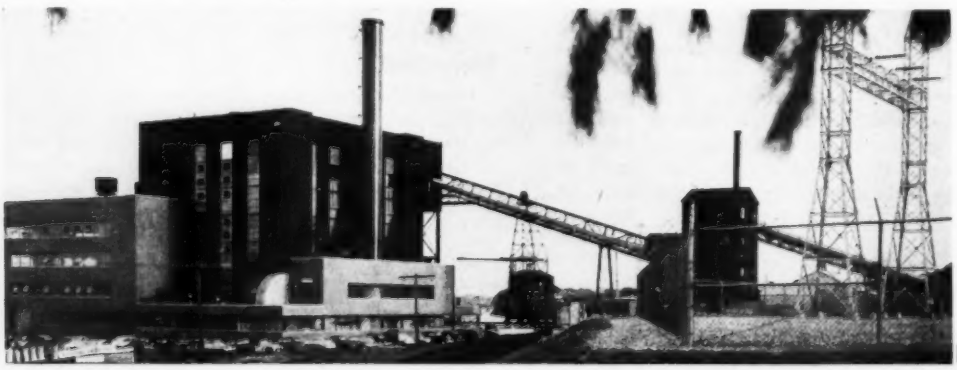
MERCURY-VAPOR CYCLE

W. N. Oberly,
Unit Equipment Division, General Electric Co.

THE mercury-vapor cycle is a binary cycle for producing power from fuel with greater thermal efficiency than is possible from the steam cycle alone. The mercury vapor cycle can also be considered as a steam cycle, and the by-product power, from the mercury turbine generator, as obtained at nearly the mechanical equivalent of the thermal energy.

Fig. 1 indicates why mercury topping power ratios are so high and, therefore, why the over-all station heat rate is so low. In this comparison the total heat of the mercury vapor and that of high pres-





Above — Flow diagram of typical condensing plant such as the Schiller Station.

Left — New station helps supply the 70% of state's population served by Public Service of N. H.

sure steam have been corrected to the same total heat as is contained in one pound of 2300 psig 1050 FTT steam, or to 1497 Btu. For this total heat, 9.7 lb of mercury vapor must flow through a mercury turbine for each pound of 2300 psia steam flowing through a steam turbine.

Curves

As a basis for comparing the topping capabilities of the cycles, the upper curve is a plot of the available energy of approximately 9.7 lb of mercury vapor when used to produce topping steam at various pressures in the mercury condensing boilers. The lower curve shows the available energy of one pound of 2300 psia steam in a turbine and exhausting at the indicated back pressures. At 400 psig pressure the available energy ratio of mercury to steam is 442 to 220; at 1250 psig, 320 to 87.

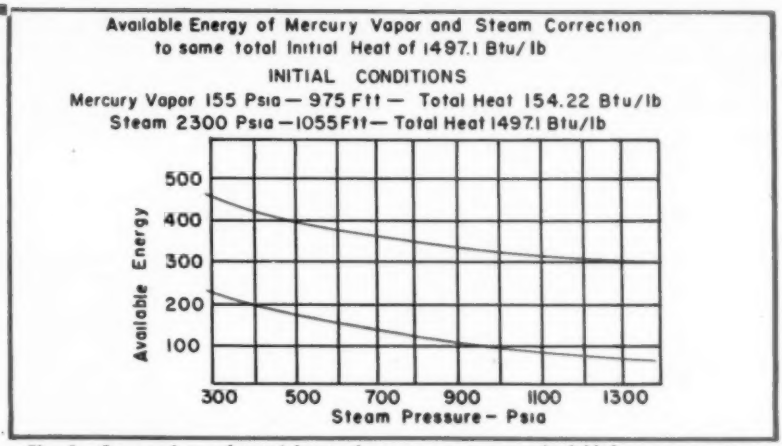
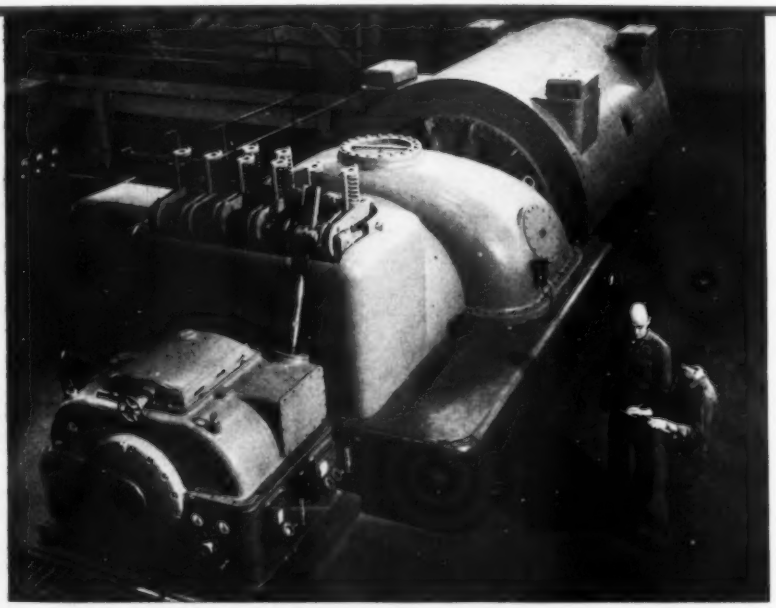


Fig. 1—Comparison of total heat of mercury vapor and of high pressure steam.



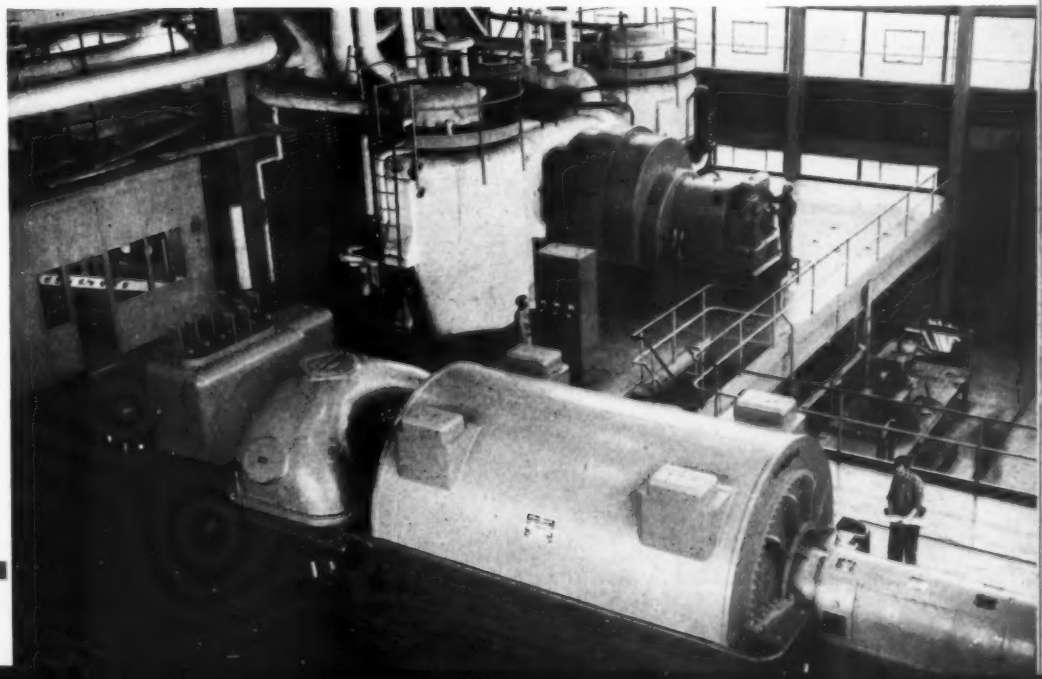
at design rating, the net heat rate with Bunker "C" fuel oil is expected to be 9200 Btu per net kwh, and 9420 Btu per kwh when coal is burned.

Both mercury boilers, complete with their coal and fuel and oil supply systems and other associated equipment, are housed in high ceiling boiler and coal preparation room adjacent to the turbine room. Also located within this area are the various water treating, water storage, and feedwater heating equipment, auxiliary power supply, and other accessories.

To a considerable degree the entire station follows the general design and arrangement of the usual steam generating station with only minor alterations in the equipment arrangement to meet the requirements of the mercury-steam cycle. Two induced draft fans, with one centrally located stack, and the ash precipitation equipment are mounted in a low extension at the extreme western end of the building.

Above — Recording performance data on the 25,000 kw steam turbine-generator.

Right—Steam turbine-generator is shown in foreground and one of the mercury units in background.



Fuel burning equipment of the two types are of standard designs with the exception that a set of low load fuel oil burners have been provided for each mercury boiler to satisfy expected station minimum load conditions. When the plant is operating in Bunker "C" oil, as is the case at the present time, the fuel flows by gravity from the main storage tanks into the 3000 gallon station storage tank which is located in a concrete vault at the western end of the building. The fuel oil is then pumped from this storage tank through the fuel oil heating system, metered, and finally burned in the mercury boiler furnace at the rate required to satisfy the station load demands.

Bituminous

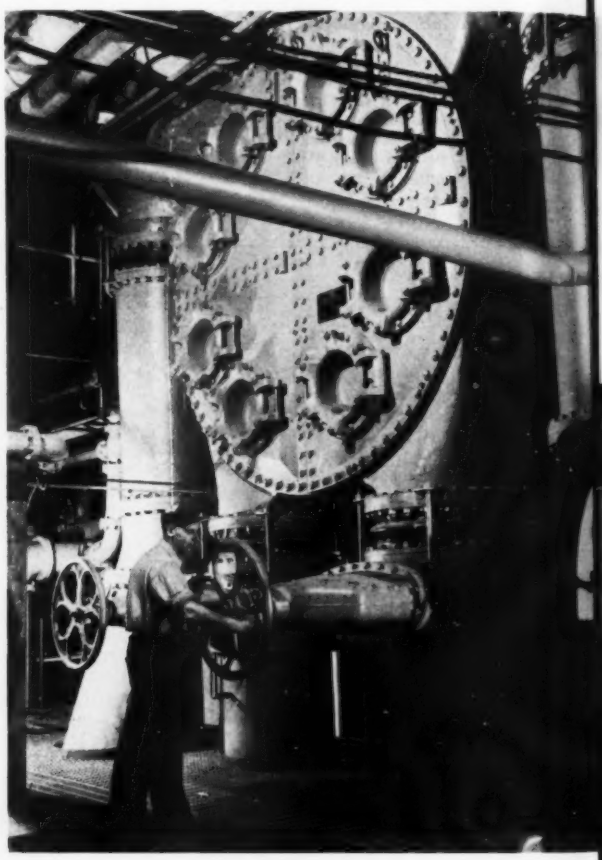
For operating the plant with pulverized bituminous fuel, crushed coal from the storage yard may be brought into the station by means of an inclined-belt coal conveyor, which then distributes the coal to the 1000 ton coal bunker mounted in the coal preparation bay at the front of the two mercury boilers. The coal flows downward from the bunker through suitable pipes; it is weighed and then pulverized before entering the furnaces where combustion occurs. Fly ash produced from the burning coal will be caught by fly ash precipitation equipment and removed from the station by means of a pneumatic ash removal system.

In order that the operator may have a complete view of the main operating floor, the electrical control room is elevated above the turbine room floor. The arrangement will be of considerable value to the operating personnel in case of electrical troubles on the power distribution system or in case of difficulties within the station itself. Likewise, should the station inter-communications system fail, the electrical control room operator and the equipment and plant supervisory control room operators can readily communicate with each other by speech or signals.

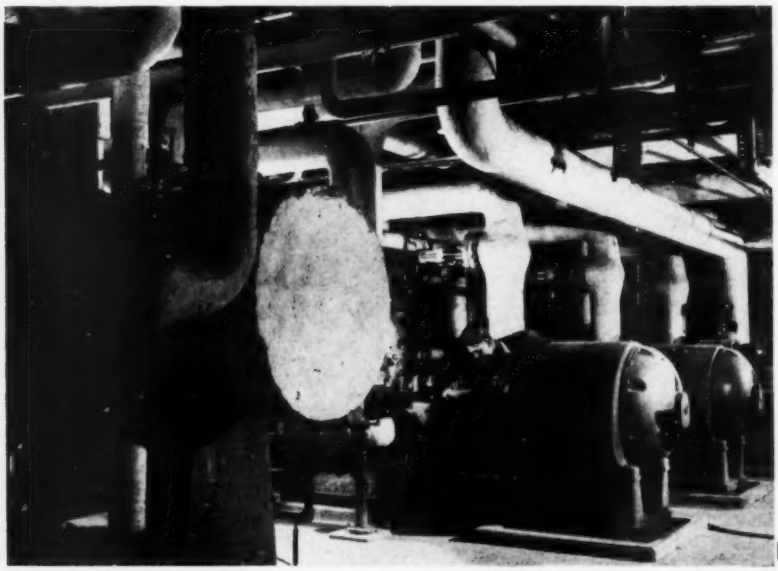
Actual control and operation of the mechanical equipment within the station is from the centrally-located supervisory control room on the main operating floor. Practically all of the auxiliary equipment is started or stopped by suitable control switches from the supervisory control room, while the three main turbine sets must be manually started by hand control on each unit.

When the plant is operated at base load, the two mercury turbines operate with their control and stop valves in the wide open position. Consequently the two units receive mercury vapor directly from the drums of the mercury boilers. The electrical output from the mercury turbine generator is, therefore, a direct function of the rate of vapor generated by the fuel supplied to the mercury boiler fuel burners; and the greater the electrical load demand, the greater the direct fuel requirements.

Effect of such an operating procedure upon the output of the 25,000 kw steam turbine generator is quite definite and positive. The steam pro-



Operator adjusts setting of huge valve that controls flow of water to the steam turbine condenser.



Inspecting boiler feed pump—one of the two units serving the station's condenser-boilers.

duced by the rejected heat of the mercury turbines' exhaust must be utilized by the steam turbine generator to produce some 60% of the total electrical output of the station. Therefore, like the two mercury turbine sets, the electrical output of the steam unit, and subsequently the entire station, is really a direct function of the rate of fuel burned in the mercury boilers. An increase or decrease in the load demands upon the station must be satisfied by the quantity of fuel burned.

If desired, the station may be operated to control the system frequency by proper manipulation of the steam and mercury turbine speed governors. At the present time the station is operating as a base load unit to utilize this plant's high efficiency and produce the maximum amount of 9200 Btu kilowatts.

Electrical

Energy is generated at 13,800 volt, 3 phase, 60 cycle, and the output of the three generators is paralleled on the 13,800 volt bus from which outgoing feeders are run to the step-up power transformers located in the outdoor substation. Power for operating the station auxiliaries is taken from the main bus through two transformers which supply two groups of 2300 volt auxiliary switchgear. Connected to each one of these groups is a load-center substation for the 460 volt services.

Motors of 100 hp and above are supplied from the 2300 volt switchgear, while the integral horsepower motors of less than 100 hp are supplied either directly from the 460 volt load centers or enclosed control panel groups located in the auxiliary switchrooms. A few motors are supplied through individual starters connected to feeders originating at the load centers. Fractional-horsepower motors and the station lighting system are supplied at 115 or 230 volts through small air-cooled transformers connected to load center feeders.

Emergency

Energy for operation of station controls and emergency lighting, should the main power supply fail, is supplied by a 60-cell storage battery.

Extensive use is made of automatic equipment for transferring auxiliary supply sources and bringing reserve auxiliaries into operation. An annunciator system informs the control room operators of the occurrence of abnormal conditions in the operation of the station, while an automatic telephone system and separate loudspeaker paging system provide communication throughout the plant.

Physical layout of the plant was established to facilitate equipment operation and to take full advantage of site terrain with regard to supplying the plant with necessary cooling and condensing water and with fuel. An intake screen house for condenser cooling water is located on the bank of the Androscoggin river east of the main building. Coal and fuel oil storage yards, and the high tension switchyard, are suitably located on the high ground beyond the railroad tracks west of the plant.

Main plant entrance and lobby, supervisory offices, testing laboratory, and electrical control and electrical switch bays are housed in a low extension on the eastern side of the plant. The mercury turbine generators, condenser boiler sets, and the steam unit, with their necessary auxiliaries and accessories, are located in a large turbine room in the center of the station.

Exterior appearance of the building was designed to emphasize the fact that the most modern and efficient equipment is installed here. The building is laid out functionally and the modern appearance was accomplished by proper use of materials rather than by artificial ornamentation.

The welded-steel frame of the main building rests on a reinforced concrete foundation mat, laid upon solid rock. The low main entrance is modernistic. Also the red face brick and ample window areas for the lower portion of the building contrast with the black prefabricated walls of the high boiler room bays to produce a modern appearing, low cost structure.

Panels for controlling the mercury units and steam turbine-generator are at left; duplex panel for switchyard breakers, at right.

One operator is shown in front of indicating board of annunciator system and another at mercury-boiler control panels.

"S" ENTIALS OF CORRECT EQUIPMENT LUBRICATION

Four fundamentals of efficient lubrication are defined by this author, who also describes an actual lubrication survey, made in the Koehring Company's plant in Milwaukee, Wisconsin. The survey resulted in reducing the number of lubricants needed from 23 to 7.

DARRYL W. JOHNSON, Chief Lubrication Engineer, Standard Oil Co. (Indiana)

"S" ENTIALS of efficient equipment lubrication in any industrial plant are: Supervise, Survey, Select, and Serve. Efficient lubrication is attained when both the user and the suppliers mutually contribute to these essentials ("S"entials) and cooperate to put the four activities into practice—a good example being the recent experience of the Koehring Company of Milwaukee.

This company manufactures excavators, concrete mixers, road pavers, and tilting mixers. A great many machine tools, some new and some old, are operated, and the concern's lubrication set-up was, up to a few months ago, too typical of many plants today. No lubrication supervision was provided, no record kept of the lubricants employed for each machine, no knowledge supplied of the inspections of the products used, and the service rendered was merely the delivery of the lubricants ordered from the supplier. Naturally maintenance costs were high.

The situation was described in detail to C. M. Sweet, head of the methods department of the Koehring Company, who subsequently handled the problem with discretion as well as authority. The Supervision part of the "S"entials, probably the most important of the four, was quickly established.

As the first step in setting up the supervision procedures Mr. Sweet relieved the machine tool operators of the duties of an oiler. In general production and piece work operators are prone to neglect the lubrication of their machines. They are not lubrication minded, never seem to have the time, their oil cans and grease containers are sometimes empty — and usually dirty. Therefore, at the Koehring plant, two men familiar with machine tools were selected to do the job of oiling and greasing all machines.

To obtain data necessary for familiarizing these oilers with the proper lubricants, their application and frequency of lubrication, a "lubrication survey" was made of the equipment in the entire plant. And this lubrication survey did not mean merely an inventory of the equipment with the corresponding guess as to the proper product to apply. The full, comprehensive survey was based on accomplishing all of the following:

1—Recommending the proper lubricant
2—Showing correct methods of application
3—Indicating the frequency for checking each bearing or system
4—Recording the change frequency for each system
5—Recording the amounts of lubricants used
6—Giving code numbers to all products if the coded system is employed
7—Presenting a description of the lubrication products recommended with their limitations.

Koehring's lubrication survey stressed especially the first six of the above items, the information being typed on cards. One card was made out for each machine and mounted in a visible file book for the oilers. Also a copy of each card was made in a master book form for the methods department.

With the aid of these visible records the oilers can now tell at a glance what their work is for the day, week, or month. "Weekly" work may be indicated by showing the day of the week. For example, an "F" placed before "weekly" on any card would

Lubrication cart carries visible files of record cards in addition to several containers of lubricants.

show this work was to be done on a Friday. In a similar manner, a date before any month indicates the particular time for the work.

For large gear cases, hydraulic reservoirs and circulating systems, the amounts added are recorded on the back of each card and initialed by the oiler. The condition of the oil as to viscosity, sediment, and acidity may also be noted. Thus at the end of each year a detailed record of the lubrication of each machine is completed.

Selection of lubricants, the third of the "S"entials, is sometimes confusing because proper selection combines buying, selling, and engineering with common sense. At the Koehring plant, personnel representing purchasing, plant oilers, operators, plant foremen, plant management and engineers met with the writer for general discussion regarding the qualifications of the lubricants. This exchange of ideas was very helpful in making final selections.

A "must" with the Koehring Company was that the number of brands of lubricants be kept to the minimum. Final selection of the lubrication products for the plant was governed by:

1—The machine tool manufacturer's recommendation
2—Oil company's recommendation
3—Operator's experience in lubricating the equipment
4—Price.

To indicate how the plan worked, the experience with radial drills, for example, can be cited. One supplier recommended a mild E. P. gear lubricant having a viscosity of 165-190 sec Say. @ 210° F for one set of gears and a viscosity of 125-130 sec Say. at 210°F for another set of gears. A different company recommended a straight mineral oil of 160 sec Say. at 210° F for the enclosed gears of the radials. A little discussion, a small amount of engineering, and some common sense was applied and a mild E. P. lubricant, having a viscosity of 165 sec Say. at 210° F was chosen for the three applications.

Another case involved two milling machines. One manufacturer, by means of a name plate, defined the lubricant for his machine as an engine oil having a 200 sec Say. viscosity at 100° F. Manufacturer of the other unit recommended a high grade machine oil with a 300 Say. Vis. at 100° F. The 300 viscosity oil was selected for both.

Checking over the entire list of manufacturers' recommendations, and applying the process employed in the foregoing examples, resulted in reducing the total number of lubricants from a possible 23 to a minimum of 7.

Service, the last of the "S"entials, began in the Koehring plant with the design and construction of a lubrication cart by their methods department. This conveyance serves the lubricant to the machine and is handled by the oiler. It carries suitable containers of the various lubricants that are to be dispensed to the frictional surfaces of all machine tools. A large space is provided at the top of the cart to hold and carry the lubrication record cards for immediate reference and follow-up. Every day this lubrication cart covers a definite route.

Service from the supplier's viewpoint should not end with the completion of a lubrication survey. Dealer service actually begins at this point, and involves a continual follow-up as to the consumption, application, costs, and quality of the products offered and in use. Many useful charts and data have been prepared and the lubrication engineer should make these available to the plants they contact. Among such material are:

1—"How to pack an Anti-Friction Bearing"
2—Annular Bearing Engineers' Committee specification for an anti-friction bearing grease
3—National Lubricating Grease Institute grease penetration numbers
4—American Gear Manufacturers' Association specifications

(Continued on page 114)

LUBRICATION CHANGE RECORD

Parts to be Lubricated	Am't. Lbs. Gals.	Date Changed	By	Date Changed	By	Date Changed	By	Date Changed	By
Head	4	April 49	AMH						
Total									

Machine: Radial Drill
Model No.: American Hole Wizard
Shop No.: 375
S-65967

STANDARD OIL COMPANY
(INDIANA)

Company: Koehring Company
Dept.: 2
Bay 380
3/1/49

INDUSTRIAL LUBRICATION RECORD

Parts to be Lubricated	Lubricant to Use	Code	Method of Application	Period: Check	Period: Change
Head *	Indoil Industrial Oil #31		Pump Circulation	D	6 Mo.
Elevating Unit *	Indoil Industrial Oil #31		" " (Filter)	D	6 Mo.
Electric Column Clamp Unit **	Standard Worm Gear Oil		Bath	W	A
Column Sleeve	Standard Worm Gear Oil		Brush	W	
Square Clamping Shafts	Standard Worm Gear Oil		Brush	W	
Bearings	Indoil Industrial Oil #31		Hand Oiled	D	
Arm Shaft & Clamp Rod Bearings	Stanobar Grease #2		Pressure Gun	6 Mo.	
*Manufacturer recommends	High Grade Machine Oil - Viscosity 275-290 @ 100°F.				
** " "	155-165 Vis. @ 210°F. Cylinder Oil Plus 5% Comp.				

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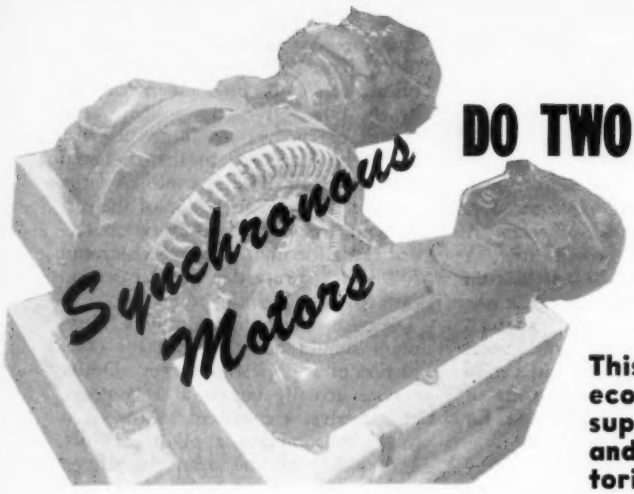
Above and right—Back and face respectively of typical lubrication record card used by the Koehring Company.



DO TWO JOBS AT ONE TIME

1.-Improve Power Factor

2.-Provide Mechanical Power

This engineer discusses the advantages and economy of synchronous motor installations. He supplies a direct-reading PF improvement chart and step-by-step solutions of several case histories which show how the chart can be applied.

R. S. PASCHAL, JR.,
Large Motor and Generator Divisions, General Electric Company

WHETHER or not a synchronous motor is chosen for a constant-speed drive depends upon the evaluation of many economic values, the foremost being operating efficiency. Good operating conditions go hand in hand with high power factor—the efficiency of the whole plant power system increases as the power factor approaches unity.

If the plant power system is loaded to full capacity, then installation of a synchronous motor drive may be possible without further increase in the kva load. Similarly, if a power system is already overloaded, then a leading power-factor synchronous motor could serve to reduce the kva load while performing its usual driving duties. Thus, a synchronous motor can frequently be called upon to do two important jobs at one time.

Magnetizing or reactive kilowatt-amperes (kilovars) — which are required by induction motors, transformers, and other apparatus—can be furnished by synchronous motors, capacitors, or both. On suitable applications — particularly on applications which have large horsepower requirements—synchronous motors inherently furnish much of the magnetizing current (corrective kilovars) at a comparatively low cost per kva. The magnetizing current furnished by the synchronous motor reduces the current drawn from the load center, and saves unnecessary overloading of the feeder line which, in turn, reduces line losses, line drop, and maintenance cost for repair or renewal of these lines.

Amount of kilovars that can be furnished by a synchronous motor depends upon its mechanical load and its field excitation. Decreasing the mechanical load without changing the field excitation increases the kilovar output of the motor. The maximum kilovars occur when the machine is excited with rated field current and carries no shaft load—i.e., when the motor is operating as a synchronous condenser. An increase in field excitation will also increase the kilovar output of the motors; however, this

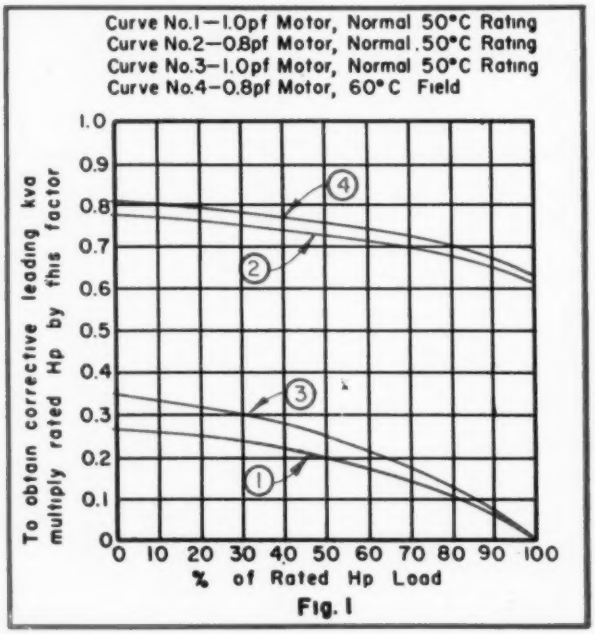


Fig. 1

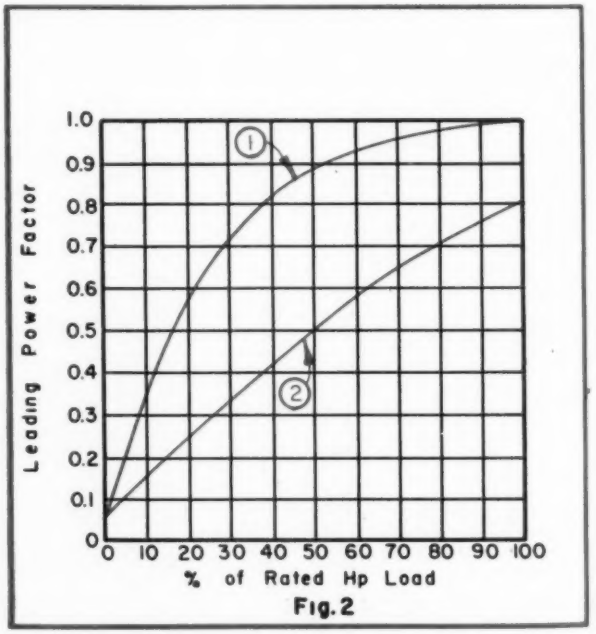


Fig. 2

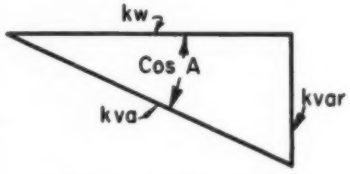
is limited by the field current rating of the motor based on heating. Fig. 1 shows approximately the amount of corrective leading kva delivered by the synchronous motor at any load with rated field current maintained. Fig. 2 shows the corresponding leading power factor of the motor.

Synchronous motors are rated at either unity or leading power factor. The kilovars delivered by a synchronous motor when operating at a known load and power factor can be calculated by the following equation:

$$KVAR = 0.746 \times \frac{HP}{Eff \times PF} \sqrt{1-PF^2}$$

When: HP is the output of the motor; PF is the leading power factor at which the motor is operating; Eff is the efficiency of the motor under the above conditions of load and power factor.

The relationship of kvar, kw, and kva is shown by the right triangle:



$$KVA^2 = KVAR^2 + KW^2$$

$$\text{Power Factor} = \frac{KW}{KVA}$$

or is equal to the cosine of the angle A

When a synchronous motor is installed in a plant which has a low power factor, full advantage should be taken of the unit's kilovar generating ability. The kilovars that a synchronous motor can supply to a plant system may be estimated from the curves on Figs. 1 and 2.

Curves 1 and 2 on Fig. 1 are for synchronous motors rated 450 rpm and below, whereas curves 3 and 4 are for motors rated 514 rpm or higher. The method of using these curves is indicated by the following sample calculation.

Example

Given a 125 horsepower, 0.8 pf synchronous motor. Required to find the kvar furnished and power factor of this motor when operated at 75 hp and normal excitation. The % horsepower = 75/125 = 60%. From curve 2 of Fig. 1, at this hp the leading kva = .72 x rated hp = .72 x 125 = 90 kilovars. Curve 2 of Fig. 2 shows the pf at 60% load to be 0.58.

Figure 3 (a) shows induction motor loads having a power factor of 0.8 lagging. A 600 hp, 0.8 leading pf synchronous motor is added to the line and is shown in Fig. 3 (b). The result is shown in Fig. 3 (c) and is further simplified in Fig. 3 (d). Although the above example shows a final power factor of 0.975, a power factor between .95 and 1.0 is usually sufficient.

Fig. 3

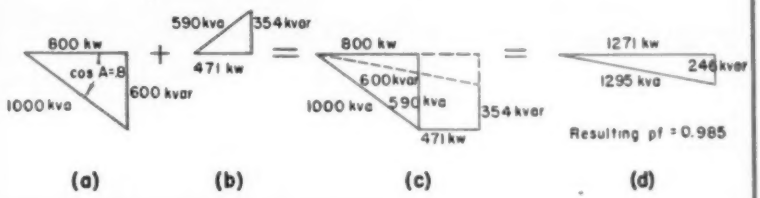
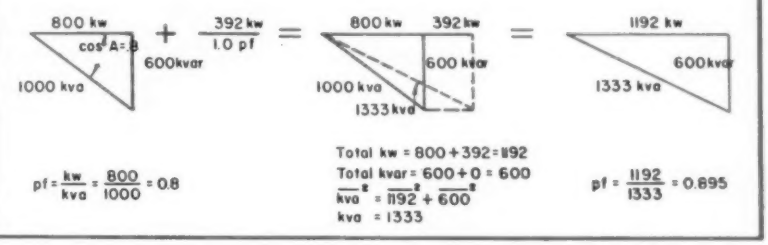


Fig. 4



Rate of return on leading power factor synchronous motors is high, depending upon the size and speed of the motor, the initial load power factor, and the nature of the rate clause. Operating a synchronous motor at less than full load to correct power factor is not advisable from an economic standpoint. Undoubtedly some other means for power factor improvement would be cheaper.

Unity power factor synchronous motors improve the plant power factor by increasing the total kva without adding to the lagging reactive kva, so that the total kva does not exceed the kw by as great an amount. Thus, an 800 kw load at .80 power factor lagging, increased to 1192 kw by a 500 hp unity power factor synchronous motor, has a new power factor of 0.895. Simultaneously, the total kva is increased from 1000 kva at 0.8 pf to 1333 kva at 0.895 pf. Calculations in Fig. 4 show the mathematical solution.

Fig. 5

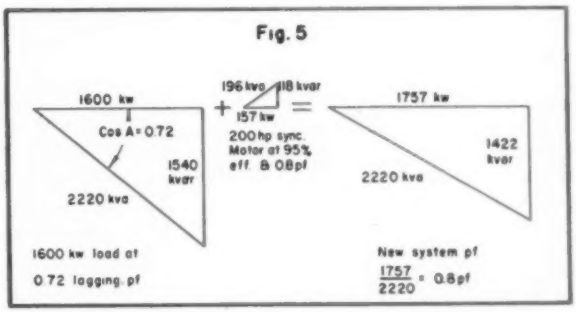
The foregoing typical examples indicate how the synchronous motor, whether a unity or leading power factor machine, can improve the over-all power factor of the plant system. The example in Fig. 5 shows how a synchronous motor can be added to the plant system without an increase in the kva load. Although the kw load is increased 157 kw, the kva load remains constant.

In summary, the benefits received from good plant power factor are: lower first cost (smaller cables and transformers), reduced losses, better power rates, and less magnetizing current furnished by the power system. Other marked advantages such as high efficiencies and compact construction make synchronous motors a logical choice as a means to improve power-factor in many applications.

Chart

Accompanying this article is a direct-reading power-factor-improvement chart which can be used to determine over-all plant power factor, allowable power loads, and answers to other power-factor problems. The chart is based on the conventional triangle diagrams for lagging-and leading-power-factor loads. Operation of the chart

Fig. 5



is quite simple; no drawings are necessary—just spot the significant points and read the values. The following four cases indicate the diversity of investigation that can be made rapidly and with slide-rule accuracy with this chart.

Case I—A load of 225 kw (or 375 kva) at 0.60 lagging power factor and 260 kw in syncronous motors. What part of the synchronous motor load should be 0.80 leading power factor to obtain an over-all power factor of 0.90 lagging?

Point A, shown at the intersection of the 225 kw and 0.60 pf lines, shows the lagging power factor load. Point B shows the total load of 485 kw at the desired power factor. From point A, draw a line C parallel to the unity power factor line (the horizontal line). From point B, draw a line D parallel to the 0.80 power factor lines (the diagonal lines). The distance from point A to the intersection of lines C and D is the required kw load (175 kw) at unity power factor and the portion from point B to this intersection is the kw load (85 kw) at 0.80 power factor required. The 85 kw is measured from the intersection of lines C and D to point B along the horizontal dotted line. This reading is taken off the kilowatt scale which is at the bottom of the chart.

Case II—A load of 625 kw (or 833 kva) at 0.75 power factor is to be supplemented by a 300 kw load, which will give a total kw load of 925 kw. What will be the respective power factor results:—with an induction motor addition at 0.90 lagging power factor; with a synchronous motor addition at 0.80 leading power factor?

Point E shows the initial 625 kw load. Line F, drawn parallel to the 0.90 lagging power factor line until it intersects the total load (925 kw) line, represents a final power factor of 0.80 lagging and 1155 total kva (indicated by the arcs) for the induction motor. Starting again a point E, line H is drawn parallel to the 0.80 leading power factor lines showing an ultimate power factor of .945 lagging and a total kva of 980 for the 0.8 power factor synchronous motor. Suppose a unity power factor synchronous motor was used to supplement this 625 kw load. Then, line G indicates this unity power factor load which gives an over-all power factor of 0.86 lagging and a 1075 total kva.

Case III—A load of 1175 kw (or 1700 kva) at 0.69 lagging power factor, indicated at point K, is to be improved to 0.85 lagging power factor.

(a) Suppose the load is to be increased. Line M shows the effect of a unity power factor addition. An additional 800 kw would be required; the result would be a total of 1975 kw and 2320 total kva at 0.85 lagging power factor.

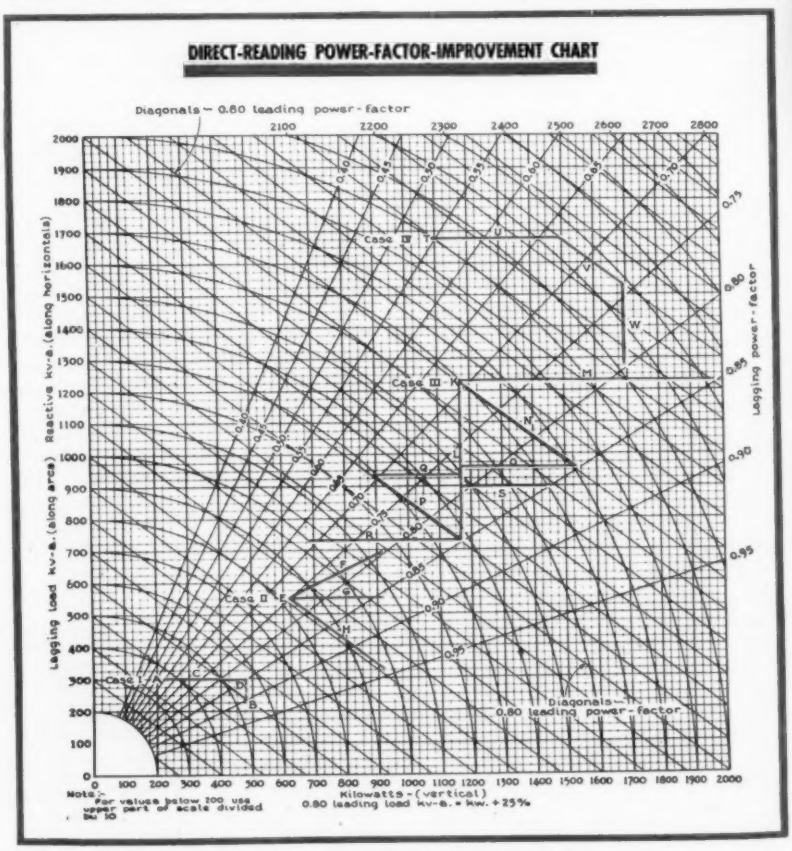
(b) Suppose again that the load is to be increased, note the effect of 0.80 lagging power factor synchronous motors. Lines N and O show such a load with N drawn parallel to the 0.80 leading power factor line. The additional load is now 365 kw (measured horizontally along line O); the total kw is 1540; and the total kva is 1810 at the over-all power factor of 0.85 lagging. (c) If the load is not to be increased, check the effect of substituting 0.80 leading power factor synchronous motors for an equivalent induction motor load. Lines P and Q show such a load, with P drawn from the intersection of the 0.85 pf line and the 1175 kw line to its intersection with the 0.69 pf line. The distance of 275 kw along line Q shows that 275 kw at 0.80 leading power factor can be substituted, while the total load remains at 1175 kw. In addition the total kva is approximately 1380 kva instead of 1700 kva.

(d) Suppose a unity power factor load is substituted for some of the induction-power load. Draw line R from the intersection of the 0.85 pf line and the 1175 kw line horizontally to the intersection with the 0.69 power factor line. This indicates that 485 kw (the length of line R) can be substituted and still obtain the same results as in (c).

(e) The desired improvement can also be made by capacitors or by a synchronous condenser. Line L indicates the required leading kva. The scale at the left using the horizontal lines shows the amount to be 500 kva leading.

Line S, drawn from the intersection of the 0.85 power factor line and the 1700 kva arc, horizontally to its intersection with the 1175 kw line, shows that 275 kw can be added at 0.85 lagging power factor after (c), (d), or (e) without exceeding the original 1700 total kva.

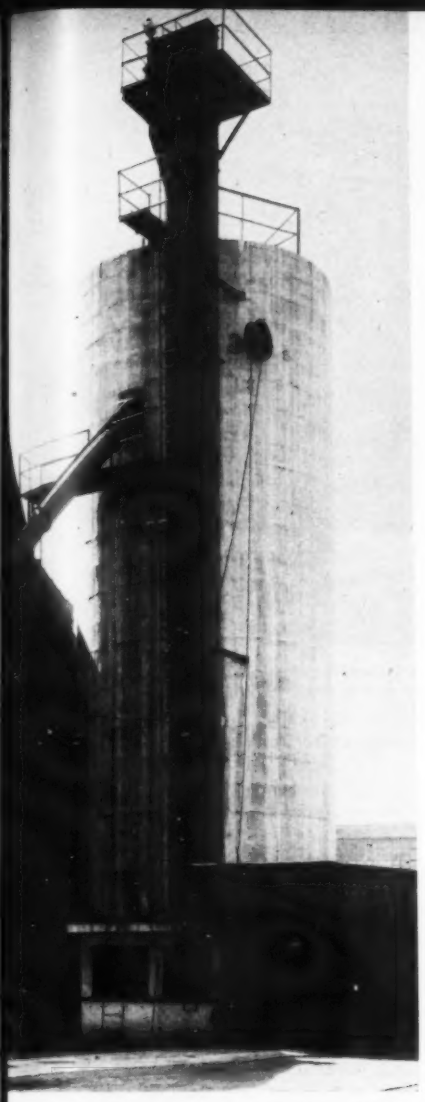
Case IV—A load of 110 kw (or 200 kva) at 0.55 lagging power factor is supplemented by 40 kw at unity power factor and 20 kw at 0.80 leading power factor. How much leading reactive kva in capacitors must be used to attain 0.80 lagging power factor over-all? Point T indicates the lagging-power-factor load; line U, the unity-power-factor load; and line V the leading-power-factor load. The vertical line W shows the capacitor load. Reading at the left, this value is found to be 25 leading reactive kva. Being under 200 kw, the plotting is done in the upper part of the scale and all values are divided by 10.


DIRECT-READING POWER-FACTOR-IMPROVEMENT CHART
Diagonals — 0.80 leading power-factor
Lagging load kv-a. (along arcs) Reactive kv-a. (along horizontals)
Lagging power-factor
Case I
Case II
Case III
Diagonals — 0.80 leading power-factor
Kilowatts - (vertical)
0.80 leading load kv-a. = kw. ÷ 25%
Note: For values below 200 use upper part of scale divided by 10

HANDLING OF SMALL COALS INVOLVES BIG PROBLEMS

Mr. Hudson discusses authoritatively a problem which has confronted the operators of practically every industrial power plant at one time or another. He presents his observations of several interesting examples of handling wet, sluggish coal, and cites, in a few instances, corrective measures which have proved helpful.

W. G. HUDSON,
Consulting Engineer



Conveyors handle wet coal readily but must be watched closely in winter.

IN MANY plants serious difficulties are often experienced in handling the small sizes (minus ½ in.) bituminous coal now generally available. This is particularly true during the winter and spring months when the coal may be wet or frozen. With the usual percentages of surface moisture, such coal refuses to flow through the gates of hopper bottom cars, builds up in the track hopper, "ratholes" in the bunker, and hangs up in the feed chutes. Conveyor systems probably have the least difficulty, as standard feeders, elevators, and conveyors can handle damp materials readily under ordinary conditions. However, in localities where near zero temperatures occur, the damp particles may freeze when in contact with steel, as on the return idlers of a belt conveyor and the belt soon runs off center.

Two factors, surface moisture and compacting, affect flowability. If the surface moisture percentage is low, compacting does not seriously increase the angle of repose. If the moisture content is above three or four percent, compacting tends to increase the angle. Coal handled direct from cars to bunker gives less trouble than coal with similar moisture content stocked out and reclaimed from ground storage. Stocked-out coal usually is rained upon and is more or less ground up by the treads of a bulldozer.

The first bottleneck in handling wet coal is in the car itself. One device for unloading sluggish contents is the recently perfected "car shaker", offered by several manufacturers. Essentially this unit is a heavy yoke, weighing about five tons, suspended from a gantry which spans the track and lowers the device until it rests upon the car. A heavy unbalanced rotor driven by a 20 hp motor then sets up a vibration in the car body to

If suitably speeded to set up sympathetic vibrations in the car body, the shaker can unload a car of flowable coal in a matter of minutes.

sift the contents down through the hopper gates. This unit costs about $6,000, plus the cost of the gantry runway and hoist. The shaker will empty a car of packed coal in ten minutes, as against six man-hours or more required for manual unloading.

When installing a shaker unit for a specific plant, the impulse rate should be checked to determine exactly the right frequency. If the device operates too fast, an extremely objectionable chatter will result and fatigue cracks will develop in the welded or riveted car plates.

Thawing

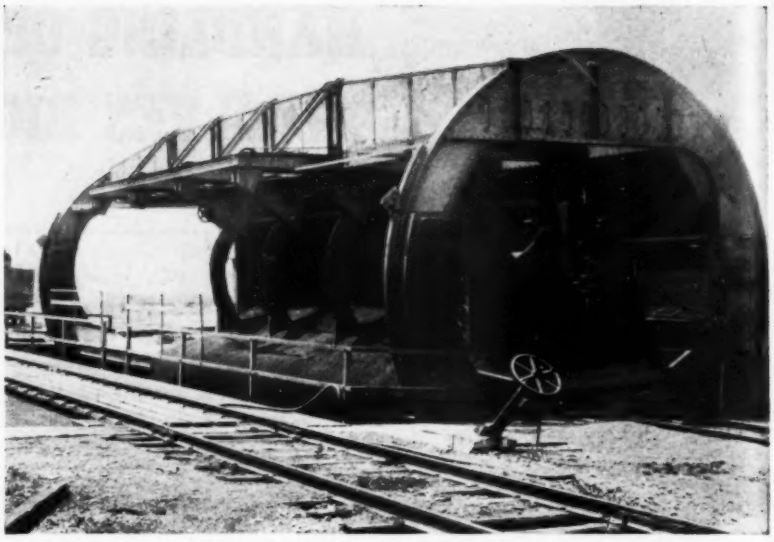
If deeply frozen, the coal must first be thawed. A radiant heat device, consisting of opposed oil or gas flame jets in an open fire-brick box located between adjacent ties ahead of the track hopper, does a good job. The investment in such an installation is about $2,000 and the coal can be sufficiently thawed in ½ hour or less with a fuel consumption of 9 to 12 gal of oil or at an approximate cost of $1.00 per car.

Frozen loads can seriously retard operations when the unloading rate is high, even when a rotary car dumper may be installed. The author watched winter performances at an Illinois preparation plant receiving coal from a strip mine. The loaded cars stood for 24 hours or more before entering the dumper. The bulk of each load flowed out nicely except for heavy gobs which were frozen to the car sides and had to be chopped loose by men with picks. Since chopping out the gobs was dangerous work, a possible improvement was to change temporarily the procedure so that cars would be dumped without standing so long after loading.

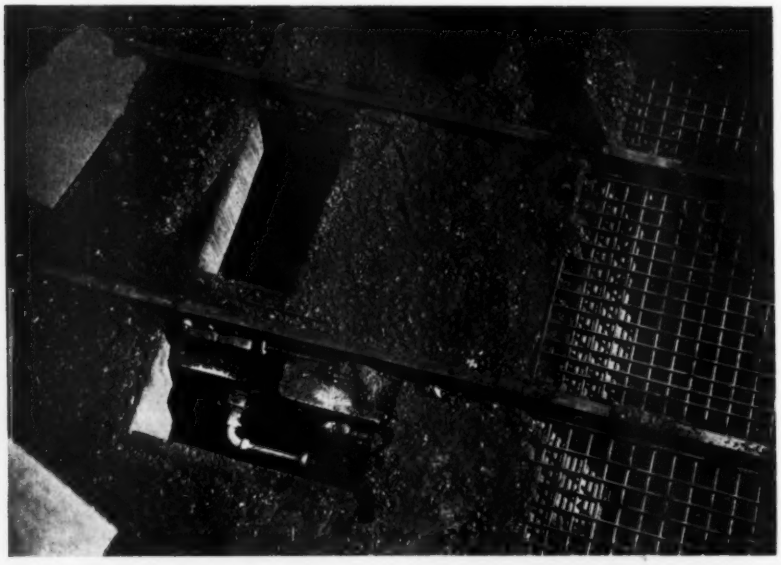
With a steady flow, coal will pass through a steeply-sided track hopper without too much difficulty. The most serious trouble occurs after the coal reaches the bunker. In the bunker the coal compacts and its repose angle approaches 90° unless the surface moisture is below 4% or so. The sticking coal must be probed or air-jetted loose. Damp coal also arches and hangs up in the feed chutes, but progress has been made, through research in contours, in relieving the tendency to jam by installing off-sets in the chute.

Outflow from a bunker can be improved if two bunker outlets of ample size are provided for each chute. They reduce the tendency to arch because stoppages above both openings seldom occur simultaneously; and the flow through one opening usually breaks down the arch above the other.

The author recalls an early pulverized coal burning plant where incoming coal was passed through a breaker and then conveyed to a service hopper and vertical cylindrical chute above each pulverizer. A yielding, suspended strip of 24 ga. stainless steel, extending from the top of the hopper down to the chute, functioned nicely to prevent the formation of arches—in effect by providing an unstable keystone. Of course the steel strip had nothing to do with the angle of repose beyond the arching zone.



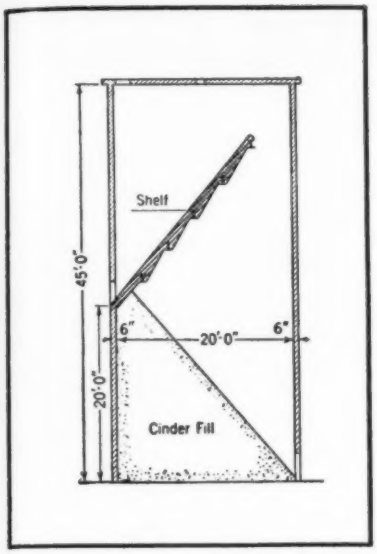
Rotary dumpers are favored where high unloading rates are required. This unit can handle ten 100-ton cars per hour unless coal is sticky or semi-frozen.



Radiant heating devices, located between rails adjacent to undertrack hopper, can thaw deeply frozen coal in ½ hour at an approx. fuel cost of $1.00.

Silo Storage

Frequently silo storage offers greater trouble possibilities than does a bunker. The typical silo has an elevated sloping floor to form a live storage compartment. The slope angle along the line where the upper floor intersects the silo perimeter on either side of the outlet, is flatter than the floor angle and the coal will not flow except for a steep cone directly above the discharge opening. For example, a concrete slab silo of this type at a Chicago plant had a floor with 45° slope for a 50 ton live storage. Although the coal stored was 1 in. slack, the storage was "live" to the extent of only 10 or 15 tons. To correct this difficulty, the contractor had to dismantle the upper half of the silo, in-



In many silos the moisture draining to outlets can make coal unflowable.

crease its height, and slope the shelf floor to 60°.

Reserve storage beneath the floor-shelf in the average silo introduces the problem of moisture draining down along the wall into the coal adjacent to the outlet gate or gates. The added moisture makes the coal completely non-flowable.

Unless the coal is always dry, silo storage for small sizes is not too satisfactory. In silos for anthracite, axial trickler chutes are commonly provided so the outflow is always from the top of the pile (not for reasons of flow but to minimize degradation). Such chutes might be an answer to improved handling of bituminous coal; however, proper functioning of a trickler chute, with coal which has a repose angle approaching 90°, is doubtful.

The difficulty of handling small coal has become acute because of the increased use of coal washed at the preparation plants and, so, shipped wet. Sometimes small coal may be purchased which has been dried by centrifugal separators after washing. The additional cost of the dried coal is often off-set by the elimination of freight paid on water.

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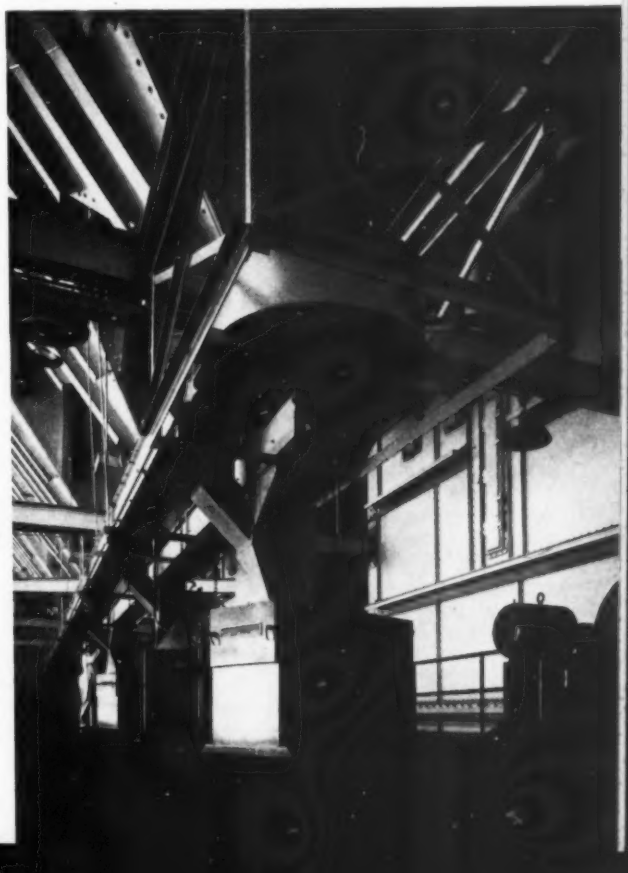
Since small coal with a surface moisture of more than 4% lacks flowability, a drying process at destination would seem logical. But because of investment cost, drying at the usual incoming rate of 60 tph or more would be impractical. A rotary dryer for a capacity of 20 tph (complete with blower, motors, and dust collector) would cost about $30,000. With such an installation coal can be delivered to a roofed open storage bin and rehandled to the dryer, but the storage bin and grab bucket rehandling equipment would add $30,000, or even more, to the costs. Nevertheless this set-up would permit any incoming coal already flowable to be sent direct to one section of the bunker while the dryer output is going to another section. A horizontal run-around conveyor beneath the bunker would allow the coal to be drawn from either section, or the wet and dry fuel could be mixed as fed out.

Crushing

A possible solution to the difficult problem of handling small coal is to reduce the surface moisture below the critical point by purchasing and crushing lump coal. Assume that a 3 in. lump, which has a surface area of about 500 sq ft per ton, has a surface moisture of 10%. If this lump is crushed to 3/8x0, the exposed area becomes about 4000 sq ft per ton. (Of incidental interest, the explosive research section of the Bureau of Mines gives the surface area of coal pulverized to 200 mesh as 500,000 sq ft per ton, and this figure gives some idea of the violence of the explosion when dust in suspension is detonated). All the freshly exposed surfaces have a surface moisture the same as the internal moisture content, which is negligible, and the average resultant surface moisture of the crushed product will be reduced to a condition favorable to free flow. "Surface moisture" is determined and expressed as so much per unit of weight. This does not change when the coal is crushed, but flowability depends on the moisture per unit of surface area.

However, the element of cost opposes this solution. The price of raw small sizes may be $3.10 per ton; if washed, the coal will cost about $4.50. Large sized coal—6 in. x 3 in. lump—will cost about $4.85 per ton, plus the cost of crushing at destination.

Even when the coal has passed through the chutes the trouble is not ended. On occasion, some types of pulverizers clog with wet coal. Last winter one of the largest Ohio utility stations was forced down to 50% of capacity by pulverizer trouble. Fortunately one of the plants, with which the utility is tied-in, did not have simultaneous trouble. Incidentally several modern designs of pulverizers of the ball-mill and rod-mill types now available handle small wet coal efficiently.



Coke breeze and coal are stored in separate bunker compartments in this modern boiler plant. Horizontal runaround conveyor permits delivery of either fuel or a mixture of both as required. A similar layout would provide a means for mixing damp and dry coals to improve flowability.

SELECTING THE RIGHT PUMPS FOR TURBINE CONDENSER SYSTEMS

In this article on circulating and condensate pumps (the second of a series on industrial turbine condensers) the author supplies calculations for determining pumping heads; application tables; curves showing friction losses in surface condensers, as well as capacity limitations of condensate pumps; and information on pump controls.

TYLER G. HICKS, Engineer, Hicks Associates

IN the first part of this series of articles (which indicated the wide application of condensing turbines in industry), a simple method for condenser selection was outlined and the major factors to be considered during selection were described. Now that the condenser has been chosen, the selection of circulating water pumps and condensate pumps can be studied. This phase of condensing system planning is of utmost importance to plant engineers and executives, because daily operating costs are dependent on the number of pumps and the type of prime mover used with them.

Circulating Pumps

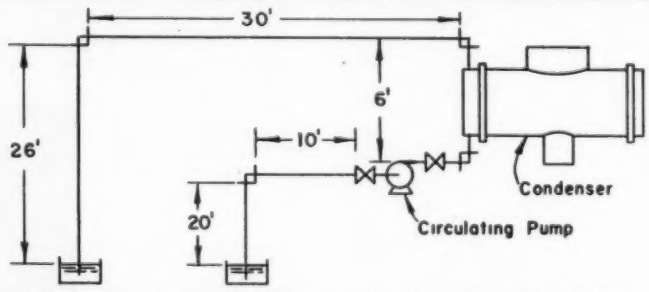
Centrifugal, propeller, or axial flow pumps can be installed to circulate cooling water. Centrifugals are especially adaptable for high suction lifts or high pumping heads. Slow speed drives are permissable with centrifugal pumps. Apparently the only disadvantage of centrifugals is the greater floor area required for proper installation. But space limitations are usually of minor importance in large industrial power plants, and as a result the majority of such plants utilize centrifugal pumps for cooling water circulation.

Propeller type pumps are best suited for plants requiring moderate or large quantities of cooling water at a low pumping head. Priming is unnecessary because the pump body is usually long enough to keep the propeller submerged, even at lowest water conditions. Propeller pumps require less floor area than centrifugals, but they sometimes need more headroom.

Axial pumps are suitable for condenser installations that require a moderate suction lift and pumping head. Space needed is about equal to that for propeller pumps. Table I summarizes the principal characteristics of the three types of circulating pumps commonly selected in industrial power plants. A study of the tabulation shows that the initial selection of pump type is determined almost wholly by suction lift and pumping head. However, other factors may rule out a given type after the condensing system has been thoroughly examined.

Normally, circulating pumps operate against the following heads: (1) static head between suction and discharge levels, (2) velocity head, and (3) friction heads at the entrance and in the piping, water boxes, and tubes. When a long vertical discharge pipe with a submerged outlet is installed, the total head is reduced by siphonic action (Fig. 1). Cooling pond or cooling tower settings (Fig. 2) and non-siphon or open settings (Fig. 3) do not have the advantages of siphonic action. As a result the total head pumped against is less in a siphon setting.

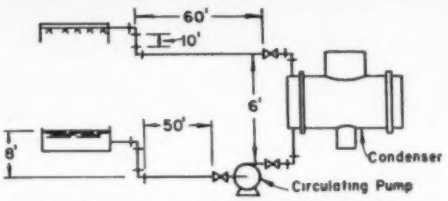
Determination of the pumping head for any given system is shown in Figs. 1 to 3, where the data for the condenser selected in the previous article is employed for illustrative purposes. Friction losses in the pipe and fittings, the velocity head, water box heads, and static heads are computed. Total dynamic head the pump must operate against is the sum of the various heads



18" Steel pipe conveying 3500 gpm; head loss 0.735'/100' of pipe

FRICTION HEAD:	Equiv. Length, Ft.	
86' of 18" pipe	86	
4-90° elbows @ 50' each	200	
3-18" gate valves @ 11' each	33	
Total equivalent length	319 ft of pipe	
Head = 319(0.735)/100 =		2.34'
VELOCITY HEAD = $\frac{v^2}{2g} = \frac{(4.85)^2}{64.32}$ =		0.37
WATER BOX AND TUBE FRICTION: From Fig. 4 for a two pass condenser with No. 16 BWG tubes, 14' long and a 6 fps water velocity =		6.75
Assumed entering and leaving loss =		1.00
Tunnel loss =		1.00
STATIC HEADS:		
Pump suction =		20.00
Pump discharge =		6.00
Siphon effect =		—26.00
Siphon loss =		2.60
DYNAMIC HEAD = ...		14.06'

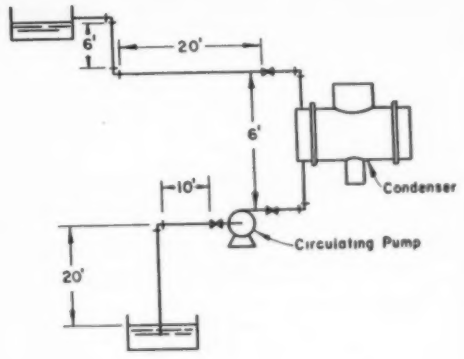
Fig. 1—Determining dynamic head in a siphon setting of an industrial power plant condenser.



18" Steel pipe conveying 3500 gpm; head loss 0.735'/100' of pipe

FRICTION HEAD:	Equiv. Length, Ft.	
128' of 18" pipe	128	
6-90° elbows @ 50' each	300	
3-18" gate valves @ 11' each	33	
Total equivalent length	461 ft of pipe	
Head = 461(0.735)/100 =		3.39'
VELOCITY HEAD =		0.37
WATER BOX AND TUBE FRICTION =		6.75
Entering and leaving losses =		1.00
STATIC HEADS:		
Pump suction =		—8.00
Pump discharge =		16.00
DYNAMIC HEAD =		19.51'

Fig. 2—Typical calculation for dynamic head in a cooling tower or pond setting.



18" Steel pipe conveying 3500 gpm; head loss 0.735'/100' of pipe

FRICTION HEAD:	Equiv. Length, Ft.	
60' of 18" pipe	60	
5-90° elbows @ 50' each	250	
3-18" gate valves @ 11' each	33	
Total equivalent length	343 ft of pipe	
Head = 343(0.735)/100 =		2.52'
VELOCITY HEAD =		0.37
WATER BOX AND TUBE FRICTION =		6.75
Entering and leaving loss =		1.00
STATIC HEADS:		
Pump suction =		20.00
Pump discharge =		16.00
DYNAMIC HEAD =		46.64'

Fig. 3—(right) Calculation for dynamic head in an open setting of condenser.

in the system. Usually practice calls for adding one or two feet to the computed dynamic head to allow for corrosion and clogging of the circulating water piping. Once the required total dynamic head is known, the type of pump needed can be chosen.

Number of Pumps

In the average industrial power plant condensing system, two pumping arrangements for circulating cooling water are usually feasible. The first arrangement involves one full capacity pump (referring to the example, a 3500 gpm pump) and the other, two half-capacity pumps (of 1750 gpm each). When complete turbine, condenser, and plant operating data are available, the most economical arrangement can be determined by computations. Should the data be unavailable at the time of planning, the best arrangement could be chosen by investigating conditions at plant localities.

For discussion purposes we can assume that the pumping head calculations (Fig. 1 to 3) indicate a centrifugal pump is best suited for installation. Such a decision would be based on the results of the calculations and the recommendations of Table I. A further investigation of centrifugal pump characteristics reveals: (1) a fairly flat efficiency curve over a wide output range makes two pump operations suitable, because comparatively small or large quantities of water can be handled without a marked decrease in efficiency; (2) centrifugal pumps can move more water when operating singly than propeller or axial flow units; and (3) two half-capacity centrifugals require only slightly more power than one full capacity unit.

Since a centrifugal pump was indicated by the calculations and since operating characteristics of two half-capacity centrifugals compare well with a single centrifugal, a reasonable first assumption, in the absence of other data, would be that two half-capacity units are satisfactory. Initial cost of two centrifugals would be probably slightly higher than a single unit, but savings in operating costs would pay quickly for the extra investment.

For instance, during periods of low temperatures inlet cooling water and moderate turbine loads (3/4 or less),

TABLE I

CIRCULATING WATER PUMP APPLICATIONS

Type	Normal Suction Lift	Normal Pumping Head
Centrifugal	Up to 15 ft	15' to 100'
Axial flow	Up to 15 ft	Up to 60'
Propeller	Submerged	Up to 25'

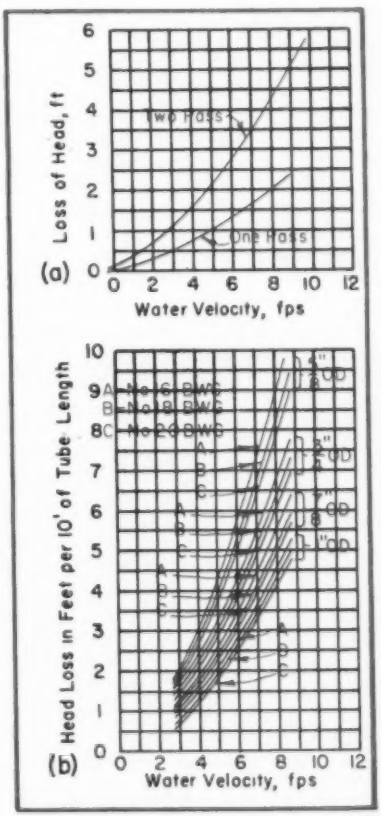


Fig. 4—Water box and tube friction losses in surface condensers. Values from these charts are employed in solving problems (Figs. 1—3.)

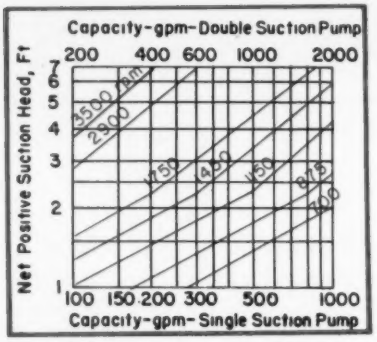


Fig. 5 — Capacity and speed limitations for single and double suction condensate pumps.

one half-capacity pump would usually be satisfactory for plant operation. The difference in power consumption during such periods depends on pump size and efficiency but might be as large as 15%. A power saving of this magnitude, spread over several months a year, certainly makes two half-capacity pumps more desirable than a single full capacity unit.

Where condenser steam loads are light for several months every year, or many hours every day, two half-capacity pumps are usually better than a single full capacity pump. Only one small pump need be operated during light loads, and this would reduce auxiliary power requirements. In plants employing contaminated cooling water, two pumps permit alternate cleaning of divided water boxes without shutting down the main turbines. If the condenser is cleaned during light turbine loads, the increase in turbine steam consumption will be slight for the duration of the cleaning period.

Fairly accurate estimate of the best pumping arrangement can be made by a logical analysis of over-all plant conditions. If, at the start, pumping head calculations indicated a propeller or axial flow pump was necessary, a similar analysis should be made to determine the best pumping arrangement. The only step needed is to plot the single and two-pump characteristics, and then conclusions can be drawn.

Of course, the more accurate analysis utilizes complete operating data for turbine, condenser, and pumps. Such data are sometimes difficult to obtain before equipment delivery. The procedure for making a mathematical analysis is briefly as follows: (1) power savings resulting from half-capacity pump operation are computed and converted to pounds of steam, (2) increase in steam flow to the main turbine during periods of half-capacity pump operation is found from the turbine vacuum correction curve, (3) the two calculated steam quantities are then compared. Whenever the increased steam flow to the turbine equals or is less than the power savings, a half-capacity pump is justified. An estimate of the duration of half-capacity operation during the year will permit a fairly accurate prediction of the annual savings that will result.

Condensate Pumps

Condensate pumps are essential equipment and are therefore always installed in duplicate, two full capacity units being required. Since condensate is handled at the boiling point, submergence of the suction is necessary. Centrifugal pumps are best for condensate service, and they can be single, 2-, or 3-stage, depending on the head to be developed. A capacity 25 to 50% in excess of normal requirements is generally provided to care for overloads, leakage of cooling water into the hotwell, or stoppage of bled steam. Condensate pump efficiencies normally vary between about 50 and 65%.

TABLE II

CONDENSATE PUMP APPLICATIONS

Number of Stages	Normal Maximum Pumping Head
1 Stage	100'
2 Stages	220'
3 Stages	350'

The normal maximum pumping head includes a 34' allowance for vacuum in the condenser served by the pump.

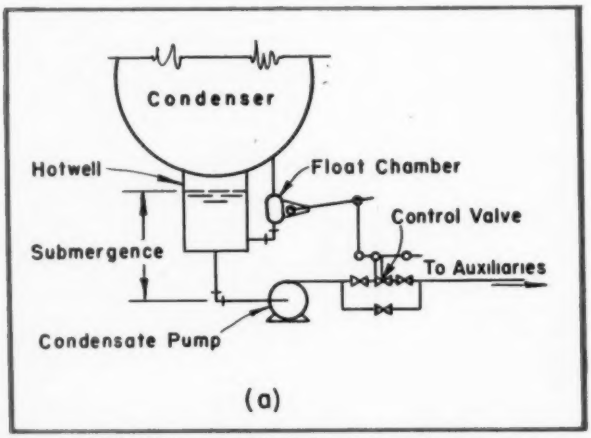
Table II summarizes the number of stages commonly employed for various heads on condensate pumps. Where several heaters and long piping runs are encountered, heads are likely to be large. Piping between the hotwell and pump suction should be liberally sized to avoid high friction losses. The maximum velocity in sizing suction piping is about 4 fps. Single-stage condensate pumps are most often applied to small plants, while two-stage units are installed in larger plants and are the most common type applied to industrial plants today.

Condensate pump glands must be sealed against air infiltration to prevent corrosion of piping, economizers, and heaters. Glands in multi-stage pumps are under discharge pressure; while special seals are incorporated in single stage pumps. A separate water seal for starting is usually necessary. Common practice calls for venting the pump suction to the hotwell to avoid air and steam binding. Typical capacity and speed limitations for condensate pumps are shown in Fig. 5.

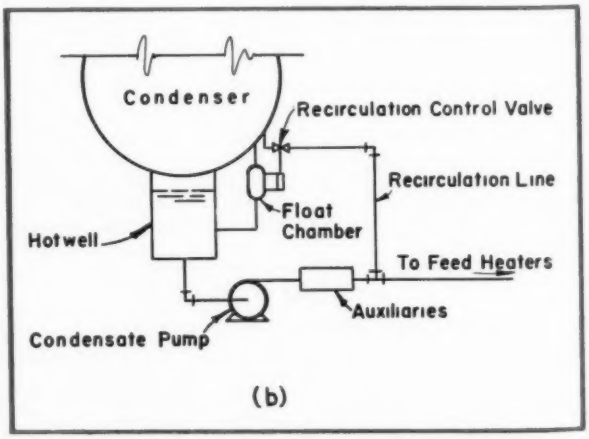
Pump Control

Condensate pumps operating in a system with uniform capacity and head frequently do not require special controls. Where head or capacity varies widely, a recirculating or throttling control is usually necessary. Uncontrolled condensate pumps have the simplest arrangement of equipment and piping and need less power than controlled units. However, cavitation, va-

(Continued on page 114)



(a) Throttling control piping for condensate pumps.



(b) Recirculating control piping for condensate pumps.

BOILER HOUSES ARE NOT NECESSARY EVILS

A timely discussion from a consulting engineer's viewpoint of the savings and improvements possible in the average industrial boiler plant. Typical figures and examples are given to indicate that boiler plants should not be considered as "necessary evils" and therefore neglected.

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MANAGEMENT burdened with many problems may, when analyzing production costs, tend to concentrate on items of direct cost and to classify others as indirect and overhead expenses that are unavoidable and subject to reduction only by costly surveys and changes. Placing the boiler house in the latter category, as a necessary evil, is an error often made, although the generation of steam for power, heat, and process work may equal the production phase of the business in opportunities for making savings.

In the average industrial plant tangible savings can often be made in the consumption of steam, compressed air, and water. Substantial reductions can also be made in the quantities of fuel oil and coal that are used. Therefore in the following an endeavor is made to present in an elementary way some essential facts to indicate possibilities for economy in connection with steam generating facilities and to expose that part of production costs directly associated with the boiler house.

Selection

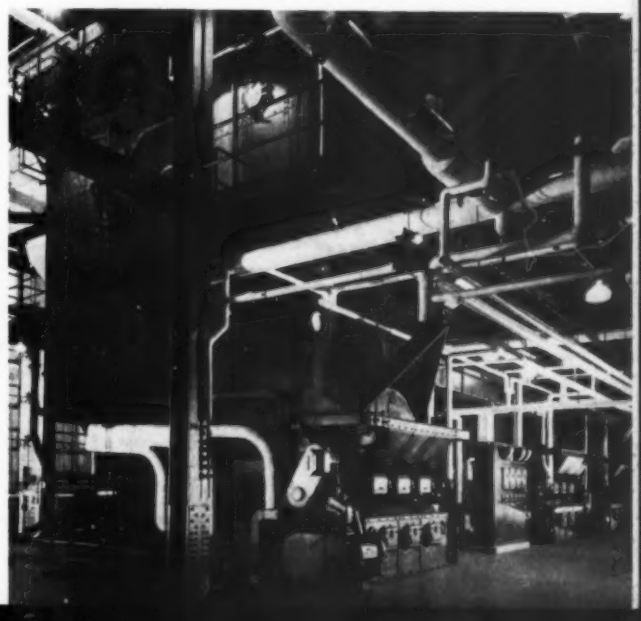
Guesswork is costly. The selection of the correct fuel for existing equipment and, in the case of a new installation, the correct equipment for burning the most economical fuel available are basically important. Each steam generating station is an individual problem because of its geographical location, operational requirements, and type and quantity of steam load. Whether the problem is that of an existing plant or a new station installation, the details of design, as well as the selection of the right equipment and fuel, should be the responsibility of a competent engineer, who is thoroughly familiar with the entire problem of establishing efficient steam generating facilities.

Crimes

Presented as examples of boiler plant crimes are the following losses, which can either be corrected or controlled and which represent a significant part of the production costs: (1) Moisture contained in the fuel and air, or formed in burning of hydrogen; (2) heat carried away in the form of dry flue gases; (3) incomplete combustion of carbon in the gases; (4) unconsumed carbon in the ash; (5) leakage in furnace setting, baffles, breeching; (6) improper amount of air to fuel ratio and draft control; (7) improper time to furnace temperature ratio which involves the furnace volume, and correct gas mixture; (8) excessive stack temperature; (9) heating surface reduction by scale and corrosion; (10) unclean internal boiler surface; (11) low temperature of boiler feedwater; (12) waste of condensate; (13) improper operation and poor control of boilers and auxiliary equipment; (14) continued use of obsolete or worn out equipment; (15) inadequate equipment maintenance; (16) waste of exhaust steam which could be utilized (incorrect heat balance); (17) uncontrolled water feed to the boilers; (18) uncontrolled boiler blowdown and absence of heat exchanger equipment for same; (19) uninsulated equipment, valves and piping; (20) steam and condensate leaks in valves, equipment, and piping, as well as lack of trap and condensate pump repair.

To improve efficiency, installation of the following standard boiler equipment can frequently be justified: (1) air preheater which employs the waste gas temperature to heat the primary combustion air; (2) economizer which utilizes the waste gas temperature to heat the make-up feedwater; (3) water-cooled boiler walls that permit higher furnace temperature, by protecting the refractory surfaces, and add to the boiler heating surface.

Considering the losses mentioned, it is safe to assume that in many cases



Because of its geographical location, operational requirements, and type and quantity of steam load, each boiler plant presents an individual problem. Even in new installations the selection of the correct equipment for burning the most economical fuel available is basically important.

the steam cost could be reduced 30% or more. See Table I. Thus, if the prevailing steam costs are 10% of the manufacturing production cost, a saving of 3% would be effected in the margin of profit.

Approximate unit cost of steam production and the saving that could be realized with a minimum investment can be indicated by a typical case such as the following.

Example: (Based on 1000 lb of steam)
Coal—$8.00 per ton @ 13120 Btu per lb
Feedwater—@ 160° F
Operating steam pressure — 180 lb absolute
Total heat-latent plus liquid equals 1196 Btu
Feedwater (160 - 32) equals 128 Btu
Heat required per lb of steam 1068 Btu
Cost per 1000 lb of steam
1068 x 1000 equals 1,068,000 Btu per 1000 lb steam

$$\frac{\text{13,120 Btu coal x 2000 lb}}{\text{800 cents (cost per ton)}}$$

equals 32,800 Btu per 1¢

$$\frac{\text{1,068,000}}{\text{32,800x.60 (annual average efficiency)}}$$

equals approx. 54¢ per 1000 lb of steam

Total cost of generation

Fuel	54.00 cents
Labor	15.50 cents
Maintenance, depreciation & property tax	8.00 cents
Electrical power and water	1.00 cents
Other insurance and taxes	0.50 cents
Supplies & miscellaneous expenses	1.00 cents
Cost—1000 lb steam	80.00 cents

Substantial savings are available at minimum expenditures, for instance:
Feedwater Heating
Fuel saving based on the utilization of exhaust steam.
Present average temperature of feedwater 160° F
Proposed average temperature of feedwater 220° F
Percentage of fuel saved

$$\frac{\text{100 (220-160)}}{\text{1196 - (160-32)}}$$

equals approx. 5.6
Combustion Control
Improved fuel-air regulation, draft control and metering equipment with an increased combustion efficiency assumed at 5%.

$$\text{Present } \frac{\text{1,068,000 Btu}}{\text{13120 x .60}} \text{ equals}$$

approx. 135.5 lb fuel per 1000 lb of steam

$$\text{Proposed } \frac{\text{1,068,000 Btu}}{\text{13120 x .65}} \text{ equals}$$

approx. 125.0
10.5 lbs of fuel

$$\frac{\text{10.5 lbs of fuel}}{\text{135.5}} \text{ equals .0775 equals}$$

7.75% fuel saving.
Note: The above figure is conservative considering average steam generating stations and could be increased substantially in many applications, particularly where the investment of heat recovery equipment could be justified.
Blowdown Heat Exchangers Equipment
Based on 7% blow-down.
Flash steam recovery
180 lb abs. operating pressure equals 346 Btu - Ht of liq.
20 lb abs. recovery pressure equals 196 Btu - Ht of liq.
20 lb abs. steam pressure equals 1156 Btu - Total Heat
20 lb abs. latent heat equals 960 Btu
60° F make-up water equals 28 Btu

$$\frac{\text{346—196}}{\text{960}} \text{ x 100 equals 15.6\%}$$

1000 lb steam x .07 equals 70 lb of steam blow-down
70 x .156 equals 10.9 lb
(1156 - 28) 10.9 equals 12,295 Btu recovery
Flash Tank Recovery
20 lb abs. pressure equals 196 Btu
60° F make-up equals 28 Btu
168 Btu

168 Btu x 70 lb blow-down equals 11,760 Btu recovery
12,295 Btu
11,760 Btu
24,055 Btu - Total theoretical recovery

$$\frac{\text{24,055 Btu}}{\text{13120 Btu coal}} \text{ equals } \frac{\text{1.83}}{\text{125}} \text{ equals}$$

1.46% fuel saving.

Thus such relatively inexpensive corrections—consisting of feedwater heating, combustion control, and heat exchanger equipment—show a 15% fuel saving. This saving reduces the cost from 80 cents per 1000 lb of steam generated to 72 cents, or a unit saving of 8 cents for every 1000 lb of steam generated.

Based on the foregoing example, the potential annual saving in dollars could be as follows:

Yearly Steam Generation (Lbs of steam)	Savings
70,000,000	5,600
90,000,000	7,200
110,000,000	8,800
120,000,000	9,600
150,000,000	12,000
200,000,000	16,000
250,000,000	20,000
300,000,000	24,000
400,000,000	32,000
500,000,000	40,000
750,000,000	60,000
1,000,000,000	80,000
1,500,000,000	120,000

Insulation

Bare pipes, valves, and equipment pay bonuses to the fuel supplier. In addition to the saving indicated by the given example, many boiler room operators and plant owners neglect to insulate piping and equipment; or, upon the destruction of covering, fail to replace it. The following tabulation briefly shows the possible saving involved.

With the small amount of piping shown in the Table II as an example, the saving with insulated pipe amounts to approximately 2½ tons of coal, or 420 gallons of oil, for one full week of operation.

Leaks

Leaking traps, valves, piping and equipment losses are serious and expensive. A ¼ inch hole in a 100 lb steam header, or valve, will emit approximately 200,000 lb of steam in one month. Converted to fuel consumption, the repair of the leak would save about seven tons of coal or thirteen hundred gallons of oil. The same size hole in a 40 lb city water main will emit over 300,000 gallons in a month's time. Likewise the monthly waste through a ¼ inch hole in a 100 lb compressed air header would be ap-

TABLE I
Approximate Percentage of Fuel Saving by Increased CO_2 in the Boiler Flue Gas Based on Average Flue and Temperature Conditions and Values

INITIAL CO_2	CORRECTED CO_2															
	7		8		9		10		11		12		13		14	
	Coal	Oil	Coal	Oil	Coal	Oil	Coal	Oil	Coal	Oil	Coal	Oil	Coal	Oil	Coal	Oil
6	6	4	10	7	13	10	15	11	17	12	19	13	20	14	21	15
7	—	—	5	3	8	5	10	7	12	9	13	10	14	11	15	12
8	—	—	—	—	3	2	6	4	8	6	9	7	10	8	11	9
9	—	—	—	—	—	—	3	2	5	3	6	4	7	5	9	6
10	—	—	—	—	—	—	—	—	2	2	4	3	5	4	6	5
11	—	—	—	—	—	—	—	—	—	—	2	1	3	2	4	3
12	—	—	—	—	—	—	—	—	—	—	—	—	2	1	3	2
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1

A modern installation such as this may be the solution to steam problems in a plant suffering from growing pains and incorrect heat balance.

proximately 4½ million cubic feet. Of course a ¼ inch hole in a service main is not likely to be neglected; however, the finding of several small leaks, which, when combined, exceed the waste mentioned, is not unusual.

In many plants the repair of leaks and pipe covering would reduce the fuel consumption and its related costs 20%. The questions may well be asked: Is the boiler room and service distribution system regarded as necessary evils because they have been neglected, or is advantage being taken of the savings that can be gained by an efficient, well maintained facility?

Know Engineer

Management should know the operating engineer. He should not be regarded as just a mechanic, but rather as a highly skilled individual whose duties require a thorough knowledge of boilers as well as mechanical, electrical, and chemical equipment.

Scope of his knowledge and responsibility are outlined in the following:

Boilers: He must understand the meaning of CO_2, the effect of stack temperature, excess air, draft, air pressure, and fuel-air ratio to achieve efficient combustion. Although not a graduate chemist, he is required to know about boiler water treatment, control the boiler water concentrations, perform water analyses, prevent scale, corrosion, foaming, and carryover. Also he has to be familiar with boiler brickwork, plastics and castables; understand furnace temperatures, fusion and expansion, and the selection of refractory materials.

Fuel: He should understand the properties of fuel, its selection, heating value, and chemical analysis; and he must operate the fuel burning equipment efficiently, arrange for adequate fuel storage, and maintain the required fuel handling equipment in good condition.

Hydraulics — Thermodynamics: His knowledge of hydraulics cannot be denied because his duties require a thorough knowledge of pumping equipment, service piping, handling of various liquids, pressure, and velocities, and the prevention of losses. Likewise his background of thermodynamics may be decidedly practical, but his knowledge of the transformation of energy with steam, gas, and air enables him to operate and maintain turbines, engines, compressors, refrigeration, and other equipment.

Electricity: The operating engineer should be thoroughly acquainted with the fundamentals of electricity, controls, motors, circuit breakers, starters, generators, circuits, and power factor. In plants generating power, he is required to control and operate the complex equipment associated with the entire power station.

Administration: In addition to his many other duties, he is usually required to systematize the recording of costs, fuel consumption, efficient steam production, water consumption, and power consumption. He directs the personnel of the boiler house, schedules maintenance work, and outlines the basic procedure for the entire facility.

The operating engineer is an expert and management should know him better, take an interest in his work, ask him questions, and become more familiar with one of the most vital departments of the plant.

This basic department, on which continuous production often depends, is deserving of a good engineer who is qualified to operate and maintain the plant in his charge at high efficiency. Hiring unlicensed engineers and incompetent help is a false step toward economy when efficient operation, uninterrupted service, and safety are jeopardized.

Heat Balance

Economical heat balance and correct load range are vital. Frequently the plant services systems for steam, water, and air are obsolete and improperly sized as the result of continuous expansion of process and manufacturing demands without proper study and consideration of the basic source, the boiler house.

In many plants today the proper utilization of steam is a neglected subject and the load range is grievously out of synchronism with the generating equipment.

Each plant is an individual problem in this regard; therefore, if a plant is suffering from growing pains and incorrect heat balance, a complete engineering survey should be made to establish the load conditions, operating costs, condition of present equipment, efficiency of operation, and reveal the economical possibilities of the changes and additions that may be required.

Steam

Plant managements should consider steam as a raw material. If the steam needed for a plant were so regarded, the assumption is safe that it would be included as a definite part of the production cost, rather than an overhead item. Steam should be given the same careful consideration that raw material procurement, labor, and other production costs receive, and the unit steam cost per manufactured article should be established. Probably, in at least half of the cases considered, the potential saving from fuel economy would exceed that which is associated

(Continued on page 118)

TABLE II

Losses in Btu per hour per 100 ft of pipe

Size Service	Bare Pipe	Standard Insulation	Btu Difference
10" 175 lb steam (sat)	262,500	30,000	232,500
6" 30 lb steam (sat)	90,000	13,200	76,800
4" 220° Feedwater	42,000	6,600	35,400
4" 160° condensate	28,400	4,750	23,650
2" 200° condensate	19,000	2,750	16,250
			384,600

NEUTRAL GROUNDING METHODS FOR INDUSTRIAL POWER SYSTEMS

This article gives consideration to some of the factors that are important in the application of neutral grounding techniques; also it indicates the methods preferred for different systems. Discussion is limited to industrial systems and voltage levels of 120 volts to 13.8 kv. This is the first article of a series.

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INDUSTRIAL power systems have improved steadily over the years, both in economy of operation and continuity of service. A contributing factor in this improvement has been the adoption of neutral grounding methods as an integral part of power system design and operation. However, grounding methods have not been uniformly applied in all cases, even within given voltage levels or by the various operating companies. On the other hand, certain systems are always grounded; for example, 120 volt lighting circuits. In view of these facts a discussion of whether or not power systems should be grounded—and, if so, by what methods—is desirable.

Neutral-grounding methods have been developed to deal with the difficulties which often arise in the operation of undergrounded systems. These problems include: insulation failures due to transient overvoltages, safety hazards to personnel, simultaneous outages due to sustained overvoltages, difficulties in finding ground faults, and sometimes higher system investment. The salient difference between ungrounded and grounded systems is that, in the former case, the system neutral is maintained at ground potential only by distributed capacitance, and in the latter case by a definite circuit from neutral to ground of known characteristics. When proper impedance characteristics are provided in this neutral circuit, the various difficulties and disadvantages mentioned may be avoided.

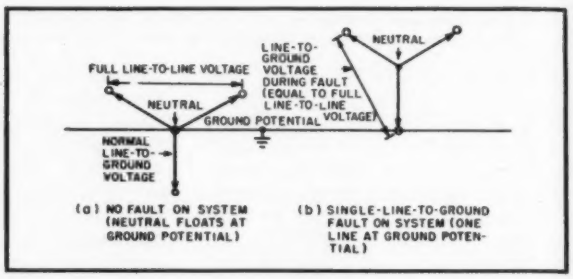

FULL LINE-TO-LINE VOLTAGE
NEUTRAL
LINE-TO-GROUND VOLTAGE DURING FAULT (EQUAL TO FULL LINE-TO-LINE VOLTAGE)
NEUTRAL
GROUND POTENTIAL
NORMAL LINE-TO-GROUND VOLTAGE
(a) NO FAULT ON SYSTEM (NEUTRAL FLOATS AT GROUND POTENTIAL)
(b) SINGLE-LINE-TO-GROUND FAULT ON SYSTEM (ONE LINE AT GROUND POTENTIAL)

Fig. 2 — System neutral is elevated during a ground fault in an ungrounded circuit.

Methods

Power system neutrals are grounded by several methods, such as: (1) solid, (2) resistance, (3) reactance, (4) ground-fault neutralizer, and (5) combinations of these with special sensitive relays. Studies of the different methods show that solid grounding is the preferred practice in industrial plants for systems rated 600 volts and below, but resistance grounding is preferred for systems rated 2.4 kv to 13.8 kv. In the latter case, grounding resistors are selected to minimize the magnitude of ground-fault current and provide satisfactory relaying of ground faults.

A ground bus system which insures low resistance between frames and enclosures of apparatus and the grounding point is more important than low resistance to earth. Particular attention should be given to the grounding of large portable electric machinery to insure safety to personnel.

Difficulties encountered in ungrounded systems may be divided into three classifications: (1) outages due to transient overvoltages, (2) damages resulting from ground faults remaining on a system, and (3) trouble in locating ground faults. In addition, a fourth consideration of grounding relates to system investment.

Overvoltages

High voltage between any phase of a power system and ground can be produced on an ungrounded system by arcing ground faults[1] and by restriking of circuit breakers during normal or shortcircuit switching in a system[2]. Tests have shown that such overvoltages may be as high as two or three times the normal line-to-neutral voltage, and that they frequently cause

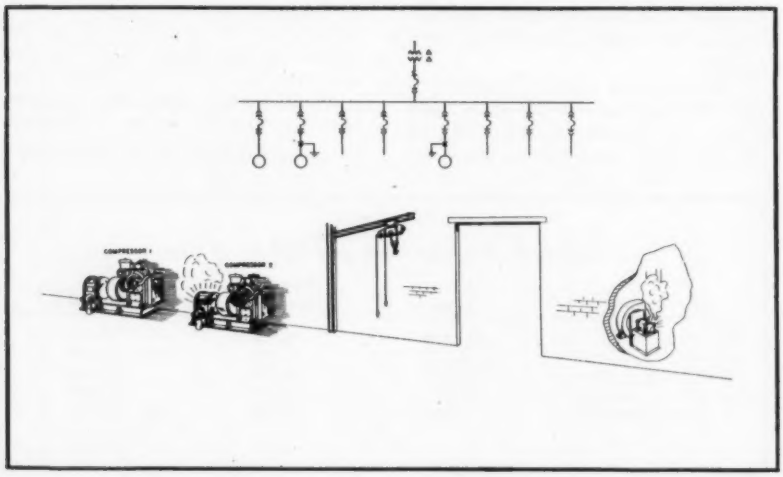


Fig. 1—One arcing ground fault on an underground system can cause a ground fault in other connected apparatus.

insulation breakdowns—in some cases at several points in the system. Thus, a line-to-ground fault on one circuit may result in damage to equipment and interruption of service on other circuits, Fig. 1.

In a grounded-neutral system a well-defined impedance exists between the system neutral and ground. Experience has shown that when this impedance is low in value, or when it consists principally of resistance, the magnitudes of transient over-voltages which may develop are greatly reduced as compared with an ungrounded system. Consequently a properly grounded system avoids this difficulty and insures lower maintenance expense as well as continuity of service.

Ground Faults

When a ground fault occurs in an ungrounded system, no evidence of this condition may be apparent—except an indication on a ground detector, if one is present. Therefore the fault may remain on the system for an extended period of time. During this interval the system neutral will be elevated as shown in Fig. 2b and the two ungrounded phases will have full line-to-line voltage to ground. This voltage is 73% higher than the voltage which is normally applied between line and ground when no fault is present. Usually the insulation between each line and ground is adequate to withstand full line-to-line voltage. However, if this voltage is applied for protracted periods to insulation which may have deteriorated due to age or severe service conditions, insulation failures may result.

two outages to take place at once.

In a system with the neutral properly grounded by any of the common methods (except ground fault neutralizers), a ground fault is immediately and automatically tripped off the circuit. Therefore, overvoltages will not be sustained and the difficulties described will not be encountered.

Locating Faults

When a ground fault occurs on an ungrounded system, it should be located and removed as soon as possible for the reasons given. To find a ground in the system, the proper procedure is to open each feeder circuit one at a time and check the ground detector each time. Once the faulty feeder is found, the question of whether the fault is on the main circuit or one of several branch circuits must be answered. Sometimes a second ground fault will occur on the same phase before the first one is removed, Fig. 4. In this case all circuits must be opened simultaneously and then closed one at a time to find the two faulty circuits.

Presence of ground faults on an ungrounded system may prove to be an expensive condition. If the attempt is made to locate them, considerable time may be required on the part of the electricians—to say nothing of the loss of production when circuits are opened. Faults remaining on the system are a hazard to personnel and equipment, and they can result in costly damages.

The advantage of proper neutral grounding when a fault remains is that ground fault current will flow from the point of grounding through the affected feeder and branch circuit to the fault. This current is readily identified as fault current by relays, circuit breakers, and fuses; and the interrupting device nearest the fault will trip open. Therefore, the faulty circuit is automatically located within a few cycles after the fault occurs. In addition, it is automatically isolated from the remainder of the system, which is then unaffected by the presence of the fault.

System Investment

Savings, which accrue when the system neutral is grounded, are obtained because:

(a) Cable at 13.8 kv and higher voltages is less expensive on grounded-neutral systems than ungrounded systems

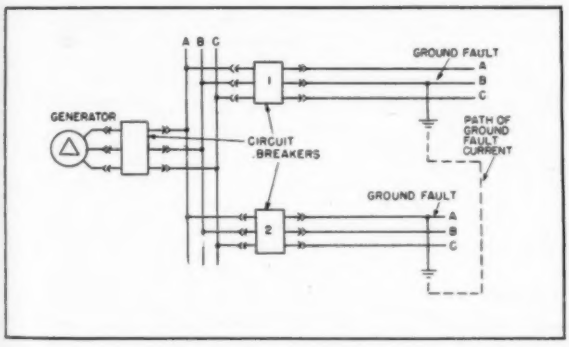
(b) Lightning arrestors for grounded neutral systems are more economical than those for ungrounded systems —this applies when the ground-fault current is at least 60% of the three-phase fault current

(c) Ground detectors are not required on grounded-neutral systems.

Depending on the particular circumstances, these savings will be offset to some degree by investment in grounding resistors — and grounding transformers, if used. Cost of such equipment should not be neglected when comparing the investment for grounded and ungrounded operation.

Disadvantages

When a ground-fault occurs on a grounded-neutral system, all of the circuit back to the first short-circuit interrupting device is de-energized. Some-



Overvoltages may result in a second ground fault on another phase, before the first is removed, as indicated by Fig. 3. A phase-to-phase fault would then exist. The short-circuit current flowing into this fault would be relatively high, and it could have been avoided, had the initial ground fault been removed. Also, if the second ground fault is on another circuit, the short-circuit current may, if the relays have the same settings, trip the breakers of both circuits. This would cause

Fig. 3 — (above) Phase - to - phase faults can occur if the original ground fault is sustained.

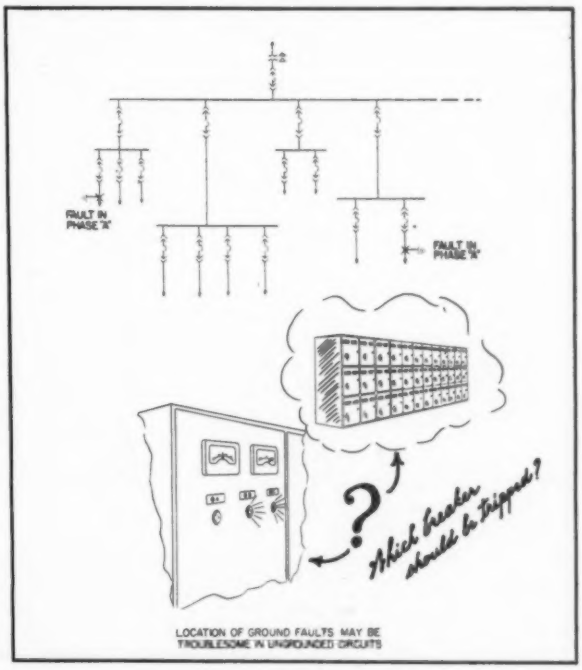

FAULT IN PHASE 'A'
FAULT IN PHASE 'B'
Which breaker should be tripped?
LOCATION OF GROUND FAULTS MAY BE TROUBLESOME IN UNGROUNDED CIRCUITS

Fig. 4 — (right) To find a fault in a system, each feeder circuit should be opened and checked with a ground detector.

times such a disadvantage is considered so important that the use of grounded systems is avoided. Attempting to theorize on this point is difficult, and the best evidence lies in experience which has been gained over the years on all types of systems, both grounded and ungrounded. Such experience reveals that the disadvantage is not as important as it seems at first glance.

In the medium voltage field (2.4 - 13.8 kv), so much trouble has been encountered with transient overvoltages, which cause extensive damage and loss of production, that grounded-neutral operation has proven its worth in this class of systems. Even in continuous process industries, such as steel mills, where an outage on a small circuit may require a complete line to be shut down, both ungrounded and grounded systems have been employed with results greatly favoring grounded-neutral systems. Many 6600 volt steel mill systems have been converted to resistance grounding with over-all benefits in lower maintenance expense and less production loss.

In the low voltage field, many plant engineers have had the opportunity of operating the same system both grounded and ungrounded. Some of the difficulties, for example the immediate outages that had been predicted, did not prove to be significant and the lower maintenance expense again pointed to the advantages of grounded-neutral systems.

Over the years, during which industrial power systems have been converted to grounded-neutral operation, no evidence has accumulated as to systems that have been reconverted to ungrounded operation.

Case History

One of the interesting aspects of grounding is that many instances have been reported showing troubles encountered in ungrounded systems, troubles which could have been avoided, had the system been properly grounded.

An example of the above condition occurred recently in a small plant which had an ungrounded distribution system. A workman ran an air hammer into a 2400 volt cable and the mishap caused a ground fault on the system. Simultaneously an important 250 hp synchronous motor on another feeder failed as the result of either transient overvoltage or a previous fault in the motor. The line-to-line fault damaged both the motor windings and laminations severely. Resistance grounding would have prevented the development of transient overvoltages and the occurrence of a motor fault simultaneously with the cable fault. Whether the motor fault was present before the second fault occurred, or whether it was caused by transient overvoltages, damage to the motor would have been minimized if the system had been properly grounded.

Common methods of grounding include: solid, resistance, reactance, and ground-fault neutralizers. Reactance grounding, in turn, may be divided into low-value and high-value reactance, each having differing characteristics which depend on the actual value of ohmic reactance. General comparisons of grounding methods are shown in Table I.

In using this table to determine a preferred method of grounding, one of the first points to look for is a method that will restrain the transient overvoltages which may develop on a system. The table shows that four methods meet the requirements of non-excessive voltage surges.

The second point to consider is whether the method will automatically locate and isolate the faulty circuit. Table I reveals that only solid, low-value reactance, and resistance grounding provide this feature.

By this analysis, the conclusion might be reached that solid grounding is suitable in all cases because it does not require an expenditure for a neutral impedance. However, a third important point, namely magnitude of ground-fault current, should be considered.

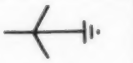
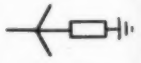
The second article is scheduled for next month's issue.

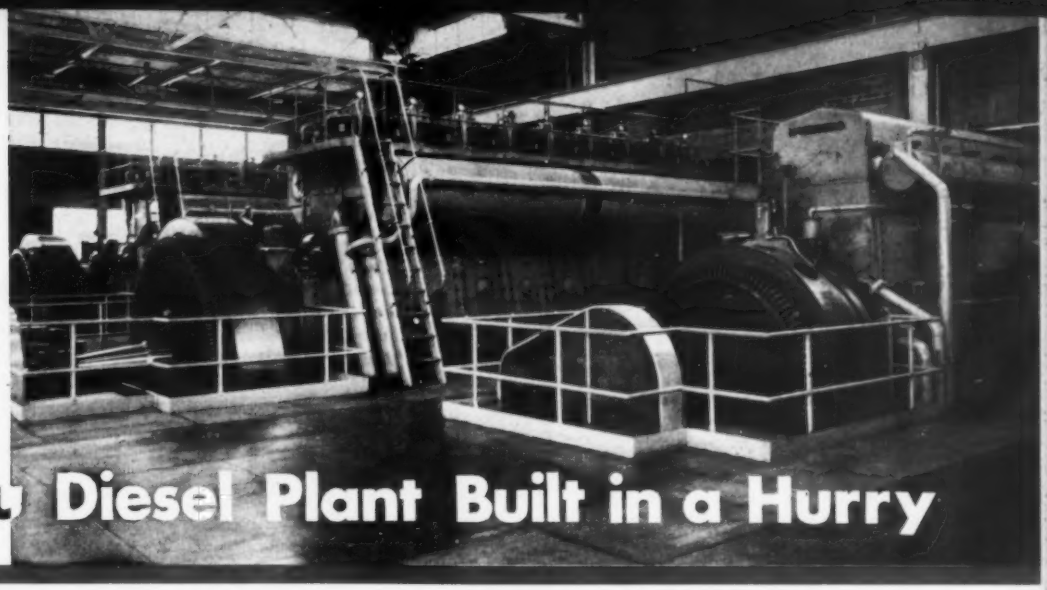
Bibliography

1. *"Arcing Faults in Power Systems" by C. Concordia and H. A. Peterson, AIEE Trans. 1941. Vol. 60, pages 340-346.*
2. *"Effect of Restriking on Recovery Voltage" by C. Concordia and W. F. Skeats, AIEE Trans. 1939, Vol. 58.*

TABLE I

Comparison of Neutral Impedance with Operating Characteristics

	Ungrounded	Essentially Solid Grounding		Reactance Grounding	Ground Fault Neutralizer	Resistance Grounding
		 Solid	Low Value Reactor	High Value Reactor		 Resistance
Current for phase-to-ground fault in percent of three-phase current	Less than 1%	Varies, may be 100% or greater	Usually designed to produce 25% to 100%	5% to 25%	Zero fault current	5% to 20%
Transient overvoltages	Very high	Not excessive	Not excessive	Very high	Not excessive	Not excessive
Automatic segregation of faulty zone	No	Yes	Yes	Yes	No	Yes
Lightning arresters	Ungrounded-neutral type	Grounded-neutral type	Grounded-neutral type if current 60% or greater	Ungrounded-neutral type	Ungrounded-neutral type	Ungrounded-neutral type
Remarks	Not recommended due to over-voltages and non-segregation of fault	Generally used on systems (1) 600 volts and below and (2) over 15 kv		Not used due to excessive overvoltages	Best suited for high voltage overhead lines where faults are self-healing	Generally used on industrial systems of 2.3 kv to 15 kv



Partial view of the station's immaculate engine room shows three of the four installed Diesels; the 1440 hp supercharged unit is at right, the two 3600 hp engines in the background. The 1500 hp supercharged Diesel is located at the other end of the room.

Caribou Diesel Plant Built in a Hurry

First unit of New England's largest Diesel generating plant was installed in open, when hydro power sources dried up, and permanent building was built around it. In less than 11 months over 10,000 hp (4 engine-generators) were completed and placed in operation.

CHARLES P. JONES,
Morrison-Gottlieb, New York

WITH the installation of the second 3,600 hp Diesel engine-generator in October, 1948, the Caribou power plant of the Maine Public Service Company reached a total rated capacity of 10,125 hp less than 11 months after the first prime mover, a 1,440 hp unit, was pressed into service in a tar-paper shack on December 23, 1947. The plant now has four engines and in April, 1949, had a record of more than 15,000 engine hours with a production of more than 19,000,000 kwh.

Expansion

Formerly this public service company, which serves a large area in Aroostook and Penobscot counties as well as New Brunswick province, depended principally on three hydro-electric plants totaling 10,500 kw capacity on the Aroostook River. But demands increased so much that the company linked its lines with the Bangor Hydro-Electric Co. and made a second connection with the 15,000 kw steam plant of the Fraser Paper Co., Madawaska, Me. Plans were initiated too for a new 8,000 kw hydro plant above Washburn on the Aroostook, and the engineering firm of Charles T. Main was engaged to design a Diesel plant to be located at Caribou.

Then the rivers went dry. To meet the emergency the Navy rushed two destroyers; the company secured eight high-speed ship service Diesels and swiftly completed two 1,000 kw installations—one at Washburn and a similar plant at Ft. Fairfield.

At Caribou, which was planned as a permanent installation and the largest of its kind in New England, company crews constructed the initial engine foundation in the open. The first Diesel—a seven-cylinder, 16 in. x 22 in., four-cycle, supercharged unit, rated 1,425 hp at 327 rpm—was quickly set up and was on the line just before Christmas 1947. Only a tar-paper roof protected the engine and operators.

Construction of the permanent building was started at once around the lone engine and the foundation laid for a second Diesel—a 3,600 hp unit. Learning they could get immediate delivery on an eight-cylinder, four-cycle, supercharged Diesel, rated 1,500 hp at 360 rpm, company officials soon had it installed and operating on the foundation prepared for the bigger Diesel.

Diesels

In July 1948, the first of the big engines—a nine-cylinder, two-cycle Diesel of 21 ½ in. bore and 29 in. stroke, developing 3,600 hp at 225 rpm—was set on the No. 3 foundation and placed in service. Next the 1,500 hp engine was moved to its own foundation at one end of the plant and a second 3600 hp Diesel put on the foundation, thus vacated. This last unit began regular service October 22, 1948.

Records

Good records have been maintained, despite the difficult operating conditions of the first year. In 1948 these Diesels generated 13,310,940 kwh, and an averaged 13.28 kwh per gallon of fuel. In the first four months of 1949, the engines generated 5,766,720 kwh and consumed 432,285 gallons of fuel to average 13.34 kwh per gallon. Performance would have been even better but for the fact that, as soon as operating conditions for the system returned to normal, load factor was not conducive to peak engine efficiency.

In periods of low water costs are ignored and all available power is obtained. For example, in February 1948, shortage month, the company's hydro plants at Squa Pan and Caribou produced nothing and the Tinker hydro station just 445,000 kwh. Meanwhile, the Caribou Diesels generated 1,143,400 kwh, the emergency plants at Washburn and Ft. Fairfield 799,600 kwh, the navy's ships provided 2,881,400 kwh and the Fraser Co. steam

plant supplied 1,262,400 kwh.

Economic considerations are paramount, however, in normal times, and the company uses the cheapest available power. Naturally, costs are lowest at its own hydro stations. Just now hydro power purchased from Bangor Hyro-Electric comes next. Diesel generated power is third in line, and steam power purchased from Fraser, fourth. Biggest factor in the Diesel costs is the price of fuel, which is 11.5 cents a gallon delivered at Caribou. With lower fuel costs Diesel power may become cheaper than purchased hydro power.

The company of course has installed Diesels to reduce the amount of power purchased from others. The hydro plants operate at capacity, Bangor Hydro-Electric supplies what is available, and the Diesels take the peaks. This has meant a Diesel production at Caribou as high as 2,173,320 kwh in a month out of total system requirements of 8,520,570 kwh. The Diesels provide dependable power at a cost below that of power which would have to be purchased and a 10,000 hp cushion against future shortages.

Engine Design

All the Caribou Diesels employ mechanical fuel injection but there the similarity ends. The two smaller units are four cycle Diesels and exhaust gases drive turbochargers which supply air to the cylinders under pressure. The two big engines are two cycle Diesels with scavenging air supplied by motor-driven blowers. The blowers, turned at 3550 rpm by 300 hp motors, supply 16,740 cfm at 2.9 psi. Since the engine powers the blower motor and the blower must run when the engine does, some arrangement was necessary to insure a quick and unfailing power supply to the blowers. Consequently the motors were connected directly to the generator leads. No fuses or circuit breakers are in the line so the motors must run when the engine runs. An alarm system warns the operator if the motor is overloaded. Also, a 125 volt bank of batteries provides pilot excitation to the generator field so that a-c voltage builds up rapidly when the generator is turned and the supply of power to the blowers is, to all practical purposes, instantaneous.

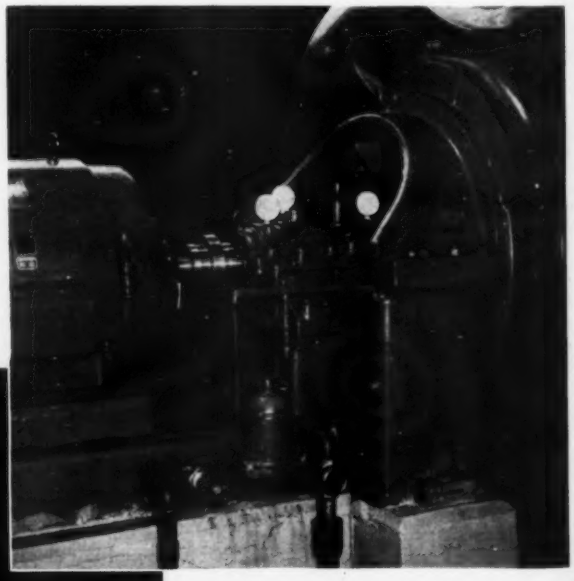
Generators

No. 1 engine drives a 1,000 kw, 1,250 kva, 3-phase, 60 cycle 4160/2400 volt generator with a 20 kw, V-belt driven exciter, and the No. 4 unit (the 1500 hp Diesel) drives a generator of the same power rating and electrical characteristics. The No. 3 and No. 4 Diesels turn 2,785 kw, 3481 kva generators with 40 kw belted exciters. The smaller units are hooked into the hydro station bus and generate current at 2400 volts, while the larger units feed directly into the main transmission line at 4100 volts. This arrangement introduces operating complications and often prevents paralleling the engines best suited to load requirements. The dual voltage system was unavoidable, however, during the emergency period when the company had to make use of available electrical equipment. A changeover to a single voltage is planned for the near future.

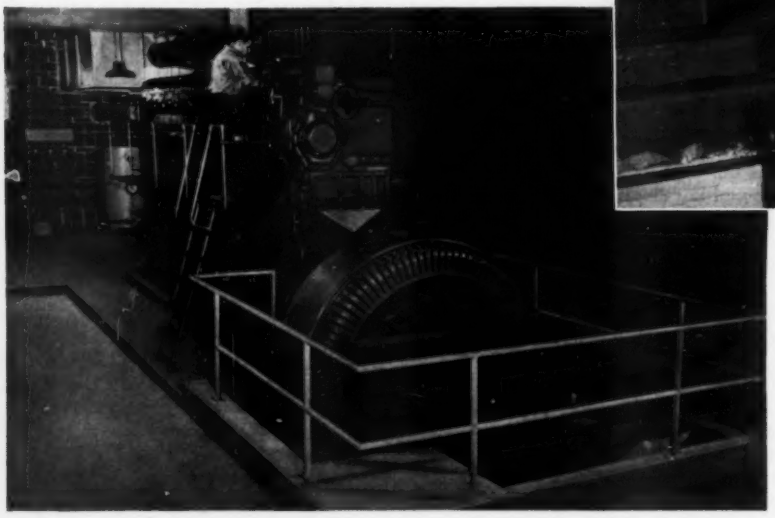
Fuel Oil

Fuel, No. 2 oil, is provided for all engines. Delivered in tank car lots, the fuel is unloaded by a pair of motor-driven, 80 gpm gear pumps through meters to a 420,000 gal vertical cylindrical storage tank near the plant. From storage the fuel is transferred through individual meters and duplex filters to 275 gallon day tanks in the engine room by motor-driven pumps automatically controlled by floats in the day tanks. Engine-driven supply pumps pick up fuel from the day tanks and send it through duplex filters to the fuel headers and injection systems. To disperse sludge, the company puts a fuel additive into the storage tank. Fuel injection for each engine is controlled by a governor.

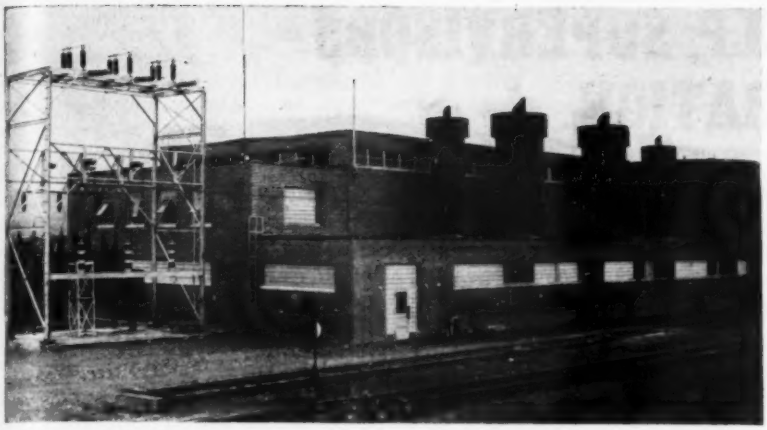
Built-in engine-driven pumps circulate the lube oil through strainers, oil coolers, and the pressure lubricating system of the Diesels. Cylinders are supplied by force-feed lubricators, one unit for the small 1400 hp engine and one for each cylinder of the large Diesels. Motor-driven auxiliary lube pumps circulate the oil before starting and



Right — A 300 hp motor drives scavenger air blower through a flexible coupling at 3550 rpm.



Left—In order to get additional power as quickly as possible during the early stages of plant construction, this 1500 hp, eight cylinder, four cycle, supercharged Diesel was placed temporarily on the foundation prepared for one of the larger engines. The unit is shown here on its own permanent setting.



Caribou's attractive building—constructed of red brick, cinder block, steel, and glass—is far removed from the original tarpaper shack of 1947.

after shutting down, and they are also arranged to start automatically if engine lube pressure drops.

Purifiers

Each engine is equipped with a continuously operating lube purifier. A motor-driven pump draws oil from the engine sumps, puts it through the purifiers and back to the sumps. In addition the oil is tested regularly and, if it shows contamination or deterioration, it is drained to a "dirty oil" tank and put through a 30 gallon refiner.

Separate closed cooling water systems serve the Diesels—a motor-driven 350 gpm centrifugal pump on No. 1, 900 gpm pumps on Nos. 2 and 3, and a 350 gpm pump on No. 4. City water, treated with a rust eradicator is circulated through the engine jackets and four shell-and-tube heat exchangers. Raw water is drawn from the river behind the racks of the hydro plants through a 30 in. line to a sump in the pump house and is circulated via a header through the heat exchangers. Three centrifugal pumps serve the system—two of 900 gpm and one of 350 gpm capacity, the larger driven by a 30 hp motor and the small by 15 hp motors. A regulator for each engine maintains engine temperature at prescribed levels by bypassing raw water around the exchanger. An alarm on the discharge side of each raw water pump sounds a siren and lights an indicator if pressure drops below 10 pounds. In addition an alarm system is installed on each engine to warn of excessive temperatures or low pressures in the lube and jacket water systems.

Starting air for all of the Diesels is supplied by two motor-driven compressors which keep five tanks at 250 lb pressure.

Filters

Intake air filters in individual chambers are provided for each Diesel, a duplex oil-bath filter for No. 1, an impingement-type filter for Nos. 2 and 3, and a waste element filter for No. 4. Louvres are arranged so that air can be drawn directly from outside or from housings around the exhaust silencers, or from both sources in any desired proportion. A slight vacuum is maintained in the engine crankcase by venting the smaller engines to the air intake of the turbo-charger and the larger engines to the blower intake. Exhaust gases for all the Diesels pass through vertical silencers. Starting air for the engines is provided by two motor-driven compressors which automatically keep five tanks at 250 lb pressure.

The big Diesels have floor mounted gage panels near the operating ends of the engines with pressure and temperature gages, alarms, and exhaust pyrometers. The smaller units have gages and pyrometers on the engine. The switchboard is an all-enclosed unit type.

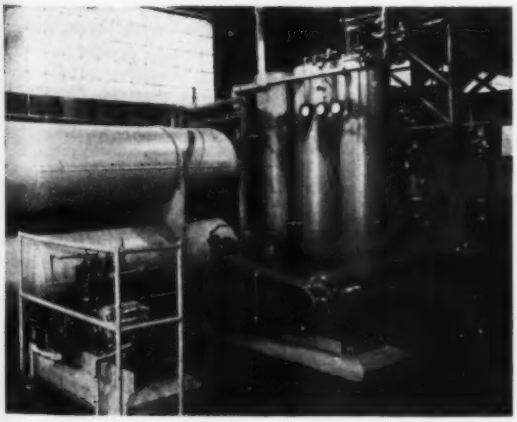
Myron Mosher is superintendent of Diesel plants for Maine Public Service, and a crew of five men under the direction of James Cleary, Diesel maintenance superintendent, keeps the engines at Caribou, Houlton, Tinker, Washburn, and Fort Fairfield in good operating condition.

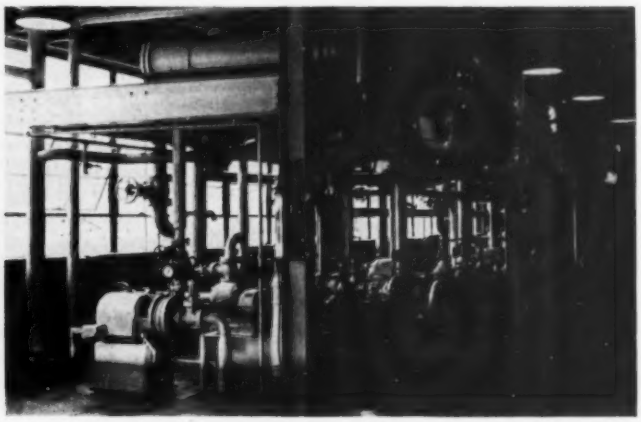
Caribou's attractive building of red brick, cinder blocks, steel and glass brick is far removed from the original tar-paper shack. As it stands today, in size, equipment, and operating record, this station is one of the nation's major Diesel power plants.

LIST OF PRINCIPAL EQUIPMENT

Diesels—Nordberg Manufacturing Co. (1400 hp and 2 of 3600 hp)
Diesels—National Supply Co.—(Superior 1500 hp)
Turbo-chargers—Buchi-Elliott Co.
Blowers—Roots-Connerville Co.
Motor—Electric Machinery Co.
Batteries—Exide, Electric Storage Battery Co.
Generators—General Electric Co., Ideal Electric Co., Elliott Company.
Fuel—No. 2, Esso, Tydol, and Sun
Filters—Wm. W. Nugent & Co., Inc.
Governor—Woodward Governor Co.
Luboil—Tydol Adetex 40, Esso Teresso 65
Strainers—Nordberg Mfg. Co.
Oil coolers—Struthers Wells Co.
Lubricators—Manzel
Aux. lube pumps—Blackmer Pump Co., Quimby Pump Co.
Lube purifier—Honan Crane Co.
Lube refiners—Youngstown Miller Co.
Cooling system centrif. pump—Allis Chalmers Mfg. Co., Ingersoll-Rand
Heat exchangers—Struthers Wells Co., Graham Mfg. Co.
Circ. Pumps—Allis-Chalmers Mfg. Co.
Temp reg—Fulton Sylphon Co.
Alarms—Viking Pump Co.
Air Filters—Burgess-Manning Co., American Filter Co.
Silencers—Maxim Silencer Co.
Compressor—Gardner-Denver Co.
Pyrometer—Alnor, Illinois Testing Lab.
Switchboard—ITE Circuit Breaker Co.

Jacket water pumps, lube pumps, oil coolers, and heat exchangers are conveniently arranged for inspection and maintenance.





FIVE STEPS HELP SUPERVISORS OBTAIN COOPERATION

Continuing his discussions on the requisites of good industrial supervision, Mr. Mottershead sets forth the essentials for better cooperation between supervisors and other members of management. In an effort to smooth the teamwork of top management, the author presents procedures for getting attention; developing interest, understanding, and faith; and getting action.

EDMUND MOTTERSHEAD, Edmund Mottershead Associates, Chicago

RECENTLY the personnel director of a prominent midwestern industrial concern—a man who has done an outstanding job in maintaining a high level of supervisor-top management teamwork as well as good labor-management relations—listed five essentials for obtaining cooperation among individuals. They are: (1) getting favorable attention; (2) developing interest; (3) developing understanding; (4) developing belief and faith; and (5) getting action. These principles can also be applied to good advantage by supervisors and other members of management in their every-day dealings with one another.

However, the given factors must not be construed as separate steps, but as continuous and interrelated with each other. Nevertheless failure to heed any one of the essentials may tend to break the chain and disrupt the whole process of achieving the cooperation desired.

One basic reason for a supervisor's or executive's failure to "sell" himself or his ideas to his fellow supervisors or to management is his neglect to carry out all of the steps in the process. If the supervisor doesn't get continuous and favorable attention, he tells his story to a stone wall of indifference. He gets a similar result when he fails to arouse interest in his idea. If the other foreman or executive who is listening to him fails to understand the problem, the former cannot have faith in what the supervisor is trying to put across. And, if the first four steps have not been accomplished, the supervisor will find that the action he wants from his associates is next to impossible to obtain.

In order to "sell" himself or his idea to management the supervisor or executive must carry out each of the five steps described in this article.

Attention

First factor in getting favorable attention is to know the other members of the supervisory and executive staff personally, as individuals, and to make friends of them. Many supervisors have the feeling that management regards them as flunkies, or just hired hands. If management is to recognize the foreman or supervisor as an individual of some worth, that same recognition must be given the members of management and the other foremen by the individual supervisor... first.

Interest

Before the interest of other department heads or management executives in a problem can be obtained, the supervisor must first analyze these people as individuals. Who are they? What are their personal desires? What personal satisfactions are they seeking? A great deal has been preached about "recognizing the worker as an individual" but frequently "management" or other department heads are thought of in an equally abstract and impersonal fashion. These men need to be thought of and treated as "Joe" and "Bill", just as do the workers. Management men, who are feeling their heavy responsibilities under current conditions, particularly want and need such personal recognition.

A second part of developing interest involves a careful analysis of each problem as it comes up. The program can then be presented as being directly related to profits, growth of the business, reduced costs, or other long range benefits and objectives—as well as to immediate economies and conveniences.

Understanding

Someone has said: "If it is possible for a thing to be misunderstood, it will be misunderstood...." Many members of management, and foremen too, have the feeling that they are harrassed on all sides by regulations, government investigators, and myriad problems in running their business. The fact is not surprising

then that these men, with their minds busy with many problems, frequently do not take the time to analyze and understand a program or idea presented by the supervisor (or by anyone else for that matter). This is particularly true in smaller organizations where the head of the business still supervises many of the details of the operation himself.

Explanations must be kept simple. If a proposal is submitted in report form, a brief summary and table of contents should preface the report itself. Brevity and clarity of statement are essential.

In addition, management men and old time foremen have been "stung" so many times by new ideas that today they demand proof before reaching a decision. However, in submitting proof, or in reviewing facts and figures in support of a given proposal, organize the evidence in such a manner that the point proven by a particular set of facts and figures can be seen at a glance. The important fact is that the other fellow may or may not seek detailed evidence on every point, but the evidence should be there. . . in such a form as to make for easy reading and easy sifting through to the conclusions.

Belief and Faith

Developing belief or faith in the minds of other executives has two aspects: belief in the supervisor as a person, and belief in his ideas or programs. As an individual, management and other department heads will tend to have faith in the supervisor who shows signs of discretion, of keeping his promises, of keeping his mouth shut at the right time, of having enough insides to stand up for his own convictions, of good judgment, and of getting desirable results. The process of developing such personal faith takes time and cannot be accomplished in a day or a week. The supervisor who has not exhibited favorable characteristics over a period of time cannot expect to receive the confidence of other foremen and members of top management.

Similarly, faith in the supervisor's ideas and programs grows as he demonstrates the soundness of his plans and the carefulness of his thinking. To demonstrate this, the attitudes of the foreman's workers must also be uncovered, so that other supervisors and executives can sense their reaction to his thinking and action.

Action

In getting action from management and other department heads, after the groundwork has been laid, several things must be borne in mind: These men like a plan to be subject to tests, to be "proved" by a sample; they like a program to be "their own ideas"; they like the "pilot-line" approach.

One of the greatest difficulties in many ideas proposed by supervisors is the practical impossibility of proving statistically that such programs will get results. Frequently so many other factors—such as labor market changes, material changes, business conditions, and price changes—can enter into the picture at the same time as the new plan that proof that a given program can accomplish anything in terms of dollars and cents becomes almost impossible. Consequently, the most acceptable ideas provide for tests and checks, and for some adequate measurements of results which are acceptable to other foremen and management men.

The executive who says "no" a hundred times and then comes up with your idea six months later as his idea is simply acting as many other executives tend to act. They like to feel that any major plan is at least partly their creation. The solution is to get them into the act. Don't ask if they will adopt such an idea. Get them to go over the details and procedures with you and ask for their help in making such procedures most effective; ask for their help in selecting a man for a key spot; ask for their help in detailing a process.

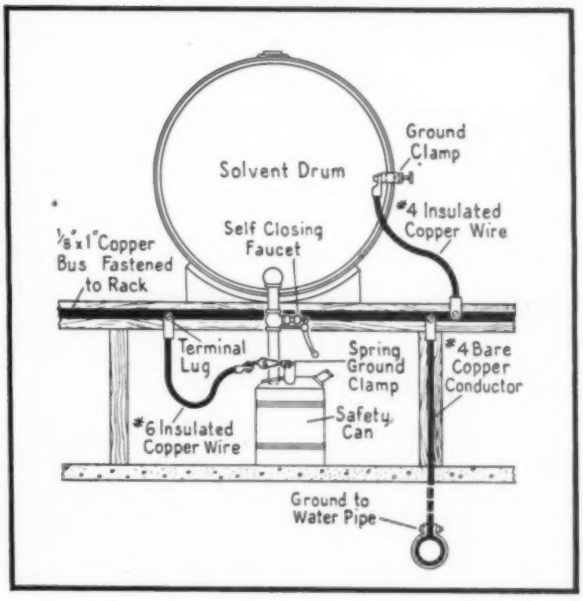
Finally, consider whether or not the "pilot plan" method can be applied to your new idea. Search for a way in which the other foremen and management men can get a "sample" and see the thing in operation before committing the whole organization and spending a lot of money? Most ideas are intangible at best, and means by which they can be tested on a portion of the operation, and then expanded for the whole organization, will tend to gain more ready acceptance.

Many executives and supervisors consider their job as primarily technical or professional and take little time for salesmanship. But the effective department head must be a good salesman as well as technically competent to manage his department and train his workers. A supervisor must deal with his subordinates and superiors on a personal and individual basis if he is to be truly successful.

Supervisors and executives who view themselves as technicians, rather than salesmen, tend to ignore the effective personal relationships which are the basis of success in dealing with their fellow staff members. Management men, after all, are men first and members of management second. They have the same likes and dislikes, the same basic desires as other peoples. The fact that management men concern themselves with problems and ideas other than those of "lower level" members of the organization is a difference similar to that between a tax attorney and an obstetric specialist; only the specific details of their jobs are different. That some management men feel they carry a greater load of responsibility makes the need to give them the personal recognition they desire and, in many cases, deserve even more important.

Guard Against Static in Handling Solvents

When flammable liquids are transferred from one container to another, static electricity is produced. Unless a good electrical connection exists between containers, the static charge may build up sufficiently to cause sparking that would ignite vapors of liquid being poured. Sketch at right shows effective method of grounding equipment. Clamps and insulated wire connect containers to grounded copper bus installed on rack. Information supplied by Associated Factory Mutual Fire Ins. Co., Hartford, Ct.



INDUSTRIAL FUTURE OF GAS TURBINES

This British author, one of Sir Frank Whittle's earliest colleagues, discusses "shaft power" (in contrast to jet propulsion), the need for compact heat exchangers, gas turbine locomotives, common transmission problems, possibilities of gas turbines in process plants, marine applications, and industrial gas turbines now in use or being built.

PATRICK JOHNSON,
Managing Director, Power Jets (Research & Development) Ltd.

WITH the coming of the gas turbine system of power production or conversion, the world gained a new tool of unprecedented flexibility; such, in fact, as to be almost universally applicable. A system — which, fundamentally unchanged, can by modification be used for ship, train, and aircraft (jet) propulsion, the liquefaction of gases, and the generation of electricity (to quote but a few diverse possibilities)—is indeed a valuable contribution to man's economy.

Jet propulsion, although a magnificent means of thrusting aircraft along, is of relatively little use as a propulsive medium for other vehicles. The propulsive efficiency is not high until speed of nearly 500 mph are attained. But when the gas turbine is used to provide *shaft* power, the matter is quite different. In relation to the power developed, the size and weight of a gas turbine are both considerably smaller than they are for the other, longer established, prime movers.

In a jet engine the only reason for having a turbine is to drive the compressor, and a turbine is used because it is about the best medium for converting the energy of the gale of compressed red-hot wind into torque. Therefore, it is easy to understand that in a jet engine the turbine is designed to extract only enough energy to drive the compressor and to leave the maximum residue in the jet stream for propulsion.

For the production of shaft power, by contrast, the turbine is designed to extract the maximum energy from the gas stream so that, after powering the compressor, as large a proportion of energy as possible is made available for shaft power. To make things more convenient, arrangements with more than one turbine wheel are not unusual. In the simple twin-wheel arrangement, for example, the first turbine drives the compressor, while the second turbine—mounted on an entirely separate shaft — produces the useful power. Somewhat curiously, this latter is known as a "free" turbine to differentiate it from the turbine which is "fixed" to the compressor. One of the advantages of the free (or power) turbine construction is that it permits ease of starting and dispenses with the necessity of elaborate clutch couplings in the drive.

Heat Exchangers

Perhaps the single item of greatest importance in the evolution of the gas turbine, at least for industrial use, is the heat exchanger, which pre-heats the air leaving the compressor by transference of heat from the exhaust. By such means a lower compression ratio, and therefore, a simpler compressor, may be employed for a given thermal efficiency. Unfortunately, most contemporary heat exchangers are bulky and heavy, are liable to distortion and sooting-up, and must thus be regarded as a potential source of trouble. A great deal of design work is, however, going on and there is no reason to doubt that the detailed problems of heat exchange design will soon be solved.

In many countries of the world, the steam locomotive still holds numerical ascendency on the railways, despite a continued trend (seen, perhaps, to best advantage in the United States) toward Diesel power systems. Aside from its excellent qualities of starting torque, the steam locomotive is outpointed by the Diesel on virtually every other count, and therefore, in assessing the fitness of the gas turbine locomotive, comparison should be made with its Diesel counterpart. That the Diesel has some advantage in efficiency, over the gas turbine at the present time, cannot be gainsaid, although the advent of a compact heat exchanger of high efficiency will tend to alter the balance.

In spite of this, the gas turbine possesses an immediate, inherent advantage in the matter of size. On British railways two 120 long-ton 1,600 hp Diesel locomotives are required for a 500 long ton express train. A 3,200 hp gas turbine could be installed on one chassis only and thus could effect an immediate saving in gross weight of something like 100 long tons. This saving in itself would permit the use of a gas turbine of less power, the modified requirement probably being of the order of 2,600 hp. In point of fact the gas turbine locomotive at present being built for British railways is powered by axial-flow unit which, driving generators, delivers 2,800 hp at the rails for traction. When comparing the fuel consumptions of the Diesel and gas turbine locomotives, therefore, an allowance in favor of the latter must always be made for this decrease in necessary power. The best argument in favor of the gas turbine will arise when a combustion chamber is fully developed for burning coal, since calculations show that coal-burning gas turbine offers a reduction of almost 50% in fuel costs relative to the Diesel.

A method has already been developed which produces a suspension of pulverized coal in high-pressure air. The mixture of pulverized coal and air is then delivered to a burner in the combustion chamber. Tests show that, by means of a series of vortex separators on the downstream side of the combustion chamber, about 95% of the ash can be removed in the separator at the cost of a pressure drop of about 1 lb/sq in. The size of particles which then pass through the gas turbine is sufficiently small to obviate damage to the blading by erosion.

In first cost the gas turbine power unit is likely to be about equal to the Diesel engine per horsepower. On this basis, the reduction in necessary power—together with the smaller vehicle, or, alternatively, one unit as opposed to two—must inevitably show a considerable saving in favor of the

gas turbine power plant.

Transmission problems of the gas turbine and the Diesel engine are somewhat similar and the majority of transmission methods appear suitable for either type. The "free turbine" principle, however, may bias choice towards simple mechanical transmission. Electric drive offers the immediate advantage of being well developed, currently available, and efficient; but, on the debit side, it is both bulky and heavy. For a long term solution, therefore, either hydraulic or direct gear drive may be found to offer considerable advantage in size and weight without sacrifice in efficiency. In this matter of power transmission it is essential that as much design attention be paid to the transmission as to the engine itself. Manifestly pointless is the spending of time and money to achieve an extra 2% of engine efficiency, if 2% of the power output is wasted by unnecessary transmission losses.

Applications

Possibilities of the gas turbine in process plants are enormously varied. As an immediately possible application, the pressure oxydizing nitric acid plant offers a convenient example. At the present time, nitric acid is produced by oxidation of ammonia, either at atmospheric pressure or under pressure of about ten atmospheres. Present-day pressure plants require a supply of approximately 1,000 kw for a daily production of approximately 55 long tons of nitric acid, the power being used in raising the pressure of the air to ten atmospheres, while the exhaust gases, at almost the same pressure, are expanded to atmosphere. However, by re-heating these exhaust gases in a heat exchanger, using some of the waste heat in the process, and then expanding them through a turbine, all the power necessary to compress the air could be obtained. Thus the plant would become, in effect, a simple gas turbine in which the oxidation process replaced the ordinary combustion chamber. The net saving of 1,000 kw makes a plant of this description highly economic and could result in reducing costs something like $65,000 a year on one plant alone.

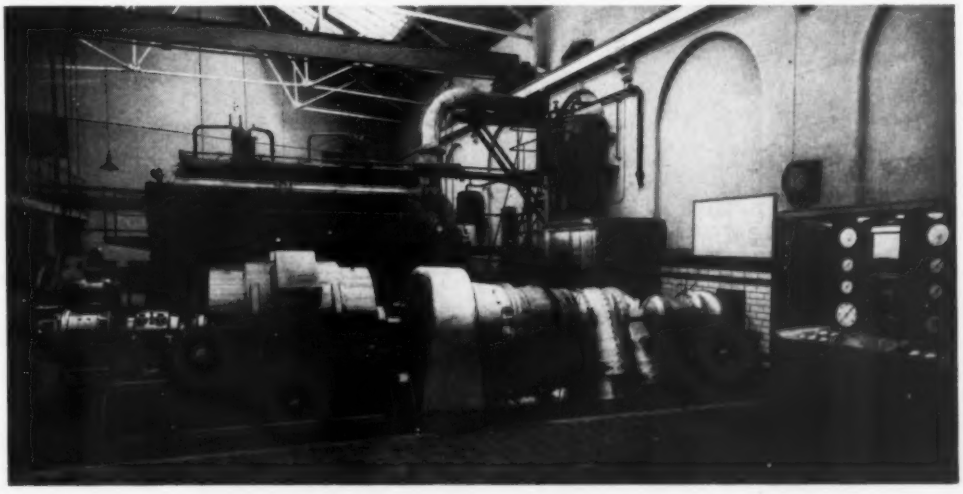
For marine applications, since the majority of large naval vessels are driven by oil-fired steam turbines, gas turbines burning boiler oil will apparently have a fuel consumption and cost no higher, and possibly somewhat lower, than those of steam turbines. The much smaller volume of gas turbine plant should undoubtedly prove to be of immense value, while the ability of the gas turbine to deliver full power quickly from "cold" starting should also have a considerable appeal in naval operations.

First installation of a gas turbine as a marine power unit was made in a 100 long-ton motor gun-boat of the Royal Navy with an axial-flow unit of 2,500 hp. So powered, the ship was found to be capable of a speed exceeding 34 knots. One English concern is developing a somewhat larger gas turbine power plant for a naval vessel of the escort type, and another company is working on an installation for a Royal Naval frigate.

Still another maritime application of the gas turbine is the 1,200 hp plant, designed and built for the Anglo-Saxon Petroleum Company's 8,200 long-ton motor tanker "Auris". In this latter installation, however, the transmission system is electrical, the gas turbine taking the place of one of the ship's four Diesel engines for purposes of extensive sea-going trials.

Little doubt exists that the oil-burning gas turbine will show considerable advantages over oil-fired steam turbines on the grounds of potentially higher efficiency, absence of stand-by losses, and lower first cost. These factors are emphasized in the case of fast passenger ships by the difficulty of accommodating large and heavy power units; in contrast to which the lighter and smaller gas turbine shows up to great advantage. The same thing applies in only slightly different degree to cargo vessels in that, for a given power, the smaller volume and weight of the gas turbine offers the possibility of greater cargo space.

In view of their long history of pioneering in turbine work it is no less than fitting that C. A. Parsons and Co., Ltd., in collaboration with the Parsons Marine Steam Turbine Co., should have been the first British firm to build and operate an industrial type gas turbine. The experimental work was initiated in 1937 and in 1943 manufacture began, the unit being started for the first time in 1945. Experience gained with this 500 hp power plant enabled the company to undertake commercial contracts and work is now in progress on a 15,000 kw gas turbine plant for the Central Electricity Board, and a 10,000 kw plant for the National Gas Turbine Establishment. The Metropolitan-Vickers Electrical Co., Ltd., in addition to the development of aircraft, marine, and railway gas turbine propulsion units, has also constructed a 2,000 kw plant for its own works at Manchester and is further engaged on a 15,000 kw plant for the Trafford Park Public power station. Another British concern to have built and operated an industrial gas turbine plant is Ruston and Hornsby. This old-established Lincolnshire Company has installed its own 1,070 hp plant for electrical generation, and the plant affords good efficiency from full load down to 40% load. This unit is remarkable in that it is, basically, suitable for stationary, marine, or locomotive installations.



Comparative sizes of a 1070 hp "all-purpose" gas turbine (foreground) and a Diesel engine of practically the same rating (background) are indicated by this side-by-side installation in the Ruston and Hornsby plant.

ROVING TRUCKERS DISTINGUISH MATERIAL HANDLING AT DRAPER

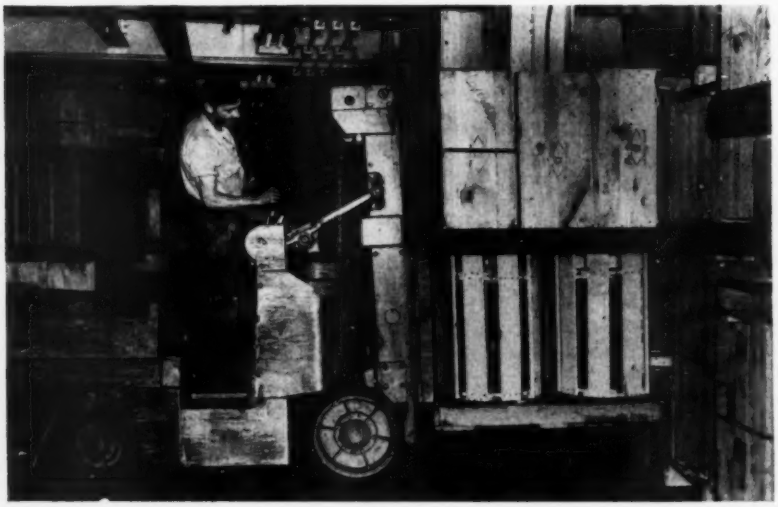
New England manufacturer of looms and textile equipment keeps 54 trucks (low lift platform types, fork trucks, hand trucks, and special units) "overloaded and overworked" through central traffic control system and coordination of all material handling activities. Results include worthwhile savings in man-hours and floor space.

IRA S. FRENCH,
Field Service Engineer, Electric Industrial Truck Association

CENTRAL traffic control and the coordination of platform lift truck, powered hand truck, and fork truck activities at the Draper Corporation's Hopedale, Mass. plant has resulted in a high utilization rate (for the company's fleet of storage battery-powered industrial trucks) and notable man-hour savings. The lift trucks, powered hand trucks, and fork trucks handle and transport materials and products in tote boxes, bins, crates, and cases, as well as on skids and pallets, throughout the plant. In addition trucks equipped with scoops are employed in the plant's foundry area to handle molding sand. Other trucks handle cores. Capacities of the platform trucks—all of the lowlift type—range from 4,000 to 6,000 lb; capacities of the fork trucks, designed to raise loads to an extreme height of nine feet, range from 5,000 to 6,000 pounds.

Requests for trucking service (except from departments having trucks regularly assigned to their operations) are made by telephone to the transportation department's dispatcher. Assignment of trucks to various plant operations is made through this department, which is No. 46 in charge of J. Laviolette, foreman of transportation. The requests are relayed to "roving truckers" who call in at the completion of an assignment or, when busy at various tasks about the plant, especially if handling routine work, call the dispatcher's office at intervals. Normal work of the roving truckers may be interrupted when demands for truck service come in from some areas or departments in which the volume of traffic has grown too great for regularly assigned truckers to handle, or from areas in which ordinarily little demand exists for a full-time truck operation.

Work handled by the roving truckers include in general: the interdepartmental movement of trains of dollies; unloading of freight cars and highway trailers; movement of machinery about the plant as part of maintenance work; servicing of departments with supplies from store rooms, and movement of product to the packing room and shipping department. Trucks are in service approximately nine hours a day, with some in use slightly longer than this.



Three battery-powered fork trucks are available for handling palletized cases of parts.

Established in 1816, the Draper Corporation serves the textile industry with high-speed looms and allied machinery, and makes its products in a wide range of types, sizes, and specifications. Nearly all of the parts required for fabrication are produced in this plant in Hopedale, which, in addition to stamping, machining, and erection departments, includes the previously mentioned foundry and a forge shop. However, in the interest of fast service for its customers in the southern textile field, many repair parts are manufactured in a foundry and machine shop maintained by the corporation in East Spartansburg, South Carolina.

Battery-powered trucks were first tried out by the Draper company in 1916. These first trucks (some of which are still in operation at Hopedale) were lowlift platform types for handling bins and skids, and for use as tractors in the towing of trains of dollie-cars from point to point. Today some 54 trucks in all are utilized daily throughout the various departments. Nineteen of these trucks are lowlift platform types, the remainder including fork trucks, hand trucks, and trucks fitted with attachments for specialized work in and around the foundry area.

Each week great quantities of material are received at the plant. One department, which is in constant receipt of items, is the foundry, and among this department's supplies are fire brick and ladle cement. Savings of more than 18 man-hours per car have been realized in the handling of the latter item alone through the substitution of a fork truck-pallet system of handling for the previous manual hand-truck method of transport and storage. A decided conservation of

warehouse floor area has also been realized.

When cement is to be handled, twenty bags are placed on a pallet, which is moved to the warehouse by electric fork truck. There the palletized loads are tiered three-high. The cement arrives in 800-bag 40-ton carload lots. Formerly 6 men took a full shift to unload and warehouse the contents of a car. Now five men do the entire job in a little less than 6 hours. Under previous methods the sacks were manually piled four-high, and only 16 bags could be placed on the same floor area now occupied by 60 bags in palletized, tiered loads.

Inspection and servicing of trucks and batteries, which are brought in every three weeks or a month, is carried out the first two days of each week, special crews being assigned to truck and battery maintenance. Overhead hoists are available for changing batteries on the trucks, some five minutes being taken for this operation at a conveniently-located central station.

Manually-moved, jack-lift type, trucks are being utilized, in addition to the powered hand trucks, mainly for spotting skid-loads, for in-process handling, or for some interdepartmental movement in congested areas. This work, however, is being taken over more and more by the powered hand trucks.

Some of the company's products are shipped assembled, and in this case they are crated. Others are erected for inspection and fitting and then are disassembled for shipment. Finished parts are stored either in the department where the last operation was performed, in adjacent areas, or in the erecting area. In any event the fork trucks are employed extensively for the handling of parts.

Parts that are completed and held in storage awaiting assembly into larger units are, for the most part, placed on pallets, the loads being tiered two- to three-high. The large structural parts are boxed, or crated, and are picked up, moved, and deposited by means of fork trucks.

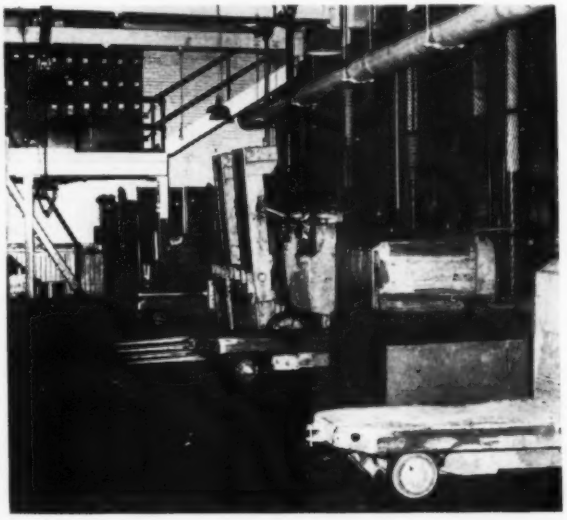
Looms are placed in export packing cases in an interesting operation, now performed by three men in a few minutes. Former manual methods required several men (equipped with winches, pinch bars, and rollers) and several hours of time.

Today a fork truck is employed to raise the loom (which weighs from 2,800 to 3,500 lb) transport it, and place it on the base of the case. Since the loom is to be bolted to the floor of the case, it must be placed precisely. Before the loom is positioned, bolts are run through the base of the case. Through the precise control afforded by the truck's electrical mechanism, the loom is lowered smoothly, a fraction of an inch at a time, until the bolts pass through holes in the loom's feet. After it has been fastened to the base (and the rest of the case erected and closed) the crated loom is ready to be moved to the shipping platform.

Fork trucks are used similarly, when standard-size box cars must be loaded with export-cased equipment. Here, also a few men in a comparatively few minutes, perform an operation that formerly required a large crew and several man-hours to complete.

Regardless of the load—whether rough castings, crude forgings, purchased or plant-produced parts—reliance is placed upon the industrial trucks for movement from point of origin, into and through process, and thence to the shipping department. The general layout of the plant (although most of the buildings are multi-storied) calls for a straight-line flow with a minor amount of backtracking. This permits work to keep moving, cuts down idle truck time, or running without pay-load, and aids the truck dispatch system. Elevators are of ample capacity to permit movement of trucks, with or without load, from floor to floor as required.

The Draper Corporation is regarded as the world's largest manufacturer of automatic, single shuttle looms for cotton and synthetic fabrics, and sometime ago management realized that many of the trucks were "overloaded and overworked, especially the older ones" and this meant maintenance was frequently higher than should be expected. As a rule, however, maintenance for the battery-powered trucks was quite low and operating costs likewise were low.



Part of fleet at charging station. Shown are lowlift platform type (foreground) and two 6,000 lb capacity fork trucks.

Lift truck accurately and smoothly positions 2800 lb loom on base of export crate.

ELECTRO-FLUID DRIVES DOUBLE PRODUCTION OF N. Y. TANNERY

Over-all improvement in operation of twelve rotary tanning drums at the Hermann Loewenstein, Inc. tannery has resulted from the installation of modern hydraulic drive units. In addition to a 100% increase in production, maintenance costs have been greatly reduced.

FRANCIS A. WESTBROOK, Mechanical Engineer

RECENT installation of individual electro-fluid drives on twelve rotary tanning drums at the large and up-to-date tannery of Hermann Loewenstein, Inc. of Gloversville, N. Y. has made possible a 100% increase in the loading of the drums. At the same time maintenance costs of the equipment have been reduced 95%.

The revolving tanning drums are 8 ft 5 in. in diameter by 6 ft wide. They hold up to 4000 lb of skins and tanning solution and rotate continuously at 18 rpm for periods of 3 to 8 hours.

Formerly the tanning drums were driven, in groups of five, by extensive lineshaft arrangements and the required complements of belts and clutches. Because of the extremely heavy loads and adverse operating conditions, an almost constant maintenance vigil was required.

Each of the twelve new drives includes a 15 hp open type constant speed a-c motor and fluid coupling combined in a single compact unit. The fluid or hydraulic coupling presents obvious advantages for the high inertia starting load. The coupling permits the motor to come up to full load speed quickly and to pick up the load gradually. In other words, the motor, with comparatively low starting torque, picks up the high inertia load without excessive starting current. Torque, developed in the coupling, increases as the square of the speed of the motor up to the point of maximum operating speed.

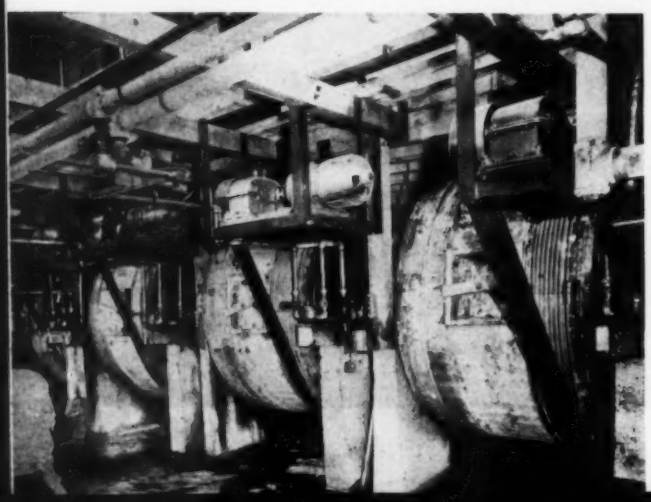
The electro-fluid drive units are direct-connected through gear type flexible couplings to double reduction herringbone speed reducers. Each electro-fluid drive and reduction gear is mounted on a common welded steel base which insures accurate shaft-alignment. On each drive unit multiple V-belts transmit power from the six-groove drive sheave on the output shaft of the speed reducer to a sectional corrosion resistant sheave on the tanning drum.* The latter sheave is held in place by monel metal tie-rods. Non-corrosive metals for both the sheave and tie-rods are required to withstand the corrosive effects of the tanning solution.

In addition to the high inertia starting load one of the most severe operating conditions, to which the drives are subjected, is the irregular loading effect caused by the shifting of the skins during the revolution of the drums. The automatic action of the fluid coupling overcomes this irregularity and provides smooth and easy starting, as well as smooth operation throughout the cycle. Consequently, larger quantities of skins can constitute each batch; in fact the loading of the drums has been doubled in some instances.

Another advantage of the new installation is the start, stop, and jog push button controls. These controls ease the spotting of drum doors in the proper position for loading and unloading. Previously much time was wasted, and many troublesome manipulations with the old belts and clutch drives were necessary, before the drum doors were stopped in just the right place.

Obviously maintenance has been reduced to the minimum. Current requirements consist only of periodic inspections and checks of the oil and grease levels. This is a marked improvement over the former task of keeping the old belts, pulleys, and clutches in operation.

Design and construction of the new drives as well as other developments and improvements to tannery machinery in operation at the Loewenstein plant, were under the direction of L. K. Morey, plant engineer. The initial electro-fluid drive installation was made in December 1947. Results were so satisfactory that similar units were placed on the other eleven rotary drums almost immediately thereafter.



Tanning drums are individually powered by electro-fluid drives, through speed reducers and V-belts. Drive units are installed overhead out of the way and push button controls are conveniently located on drum supports.

*Sectional non-corrosive V-belt sheaves on rotary tanning drums were designed and developed by L. K. Morey, Loewenstein plant engineer. Patents have been applied for.

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MAINTENANCE SHOW HITS "JACK-POT"

Industry's "forgotten man" finally came into his own at the first conference and exposition devoted exclusively to problems of maintaining plant buildings and equipment. Lubrication practices, maintenance costs and budgets, housekeeping and sanitation, electrical equipment upkeep, adaption of instruments to maintenance work, and plant lighting were among the many topics discussed by prominent speakers.

W. E. POOLE, Associate Editor

"STANDING room only" was the rule rather than the exception at all sessions of the Maintenance Conference, sponsored jointly by the American Society of Mechanical Engineers and the Society for the Advancement of Management, and held concurrently with the First Plant Maintenance Show at the Public Auditorium in Cleveland, Ohio on January 16 to 19. In addition to capacity attendance, the meetings were outstanding in regard to the high caliber of speakers and choice of topics on industrial maintenance activities.

Intense interest of the thousands of plant engineers and maintenance executives in attendance was attested by the unusually large number of pertinent questions from the floor at the conclusion of each talk. Apparently many of the attending engineers came burdened with current problems in the upkeep of plant properties and equipment, and took full advantage of the opportunity to interchange ideas with experts in their respective fields. Unfortunately, time did not permit complete coverage of all the problems presented, but everyone came away with the feeling that the conference filled a long-wanted need for a clearing house for such maintenance problems and that the entire program was successful beyond all expectations.

Lubrication

If any one session were to be selected as outstanding, perhaps the panel discussion on the topic, "Preventive Maintenance as It is Influenced by Proper and Improved Lubrication Practice", should get the nod. Chairman for this informative meeting was E. Ralph Harris, manager, industrial sales, Alemite Division of Stewart-Warner Corp. Panel members included: G. L. Sumner, lubrication engineer, Westinghouse Electric Corp.; O. L. Maag, research chemist and lubrication engineer, The Timken Roller Bearing Co.; C. L. Pope, lubrication engineer, Eastman Kodak Co.; C. E. Pritchard, chief lubrication engineer, Republic Steel Corp.; and L. A. Danse, lubrication engineer, General Motors Corp.

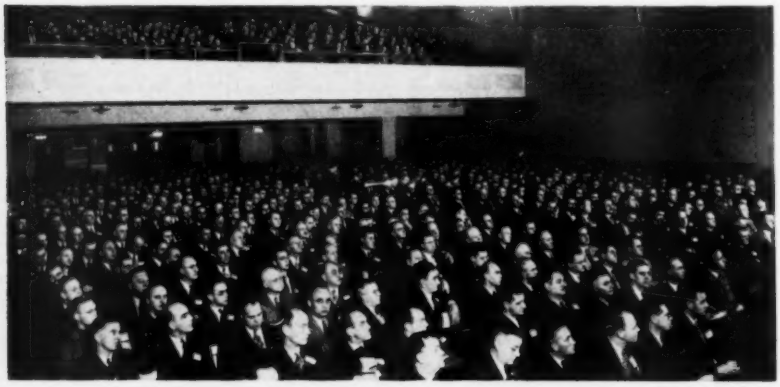
In the chairman's opening remarks, Mr. Harris quickly briefed the tremendous scope of lubrication as a preventive maintenance tool. He stressed five important factors necessary for safe, economical, and satisfactory lubrication practices: (1) selection of lubricants, (2) quality, (3) handling, (4) application, and (5) correct intervals of lubrication service.

Mr. Sumner emphasized that the main road to preventive maintenance through lubrication starts at the machine design stage. In too many cases, he said, facilities for lubrication are an after-thought, and "tacked on" devices are often so arranged that access to them for cleaning is difficult. Consequently, essential maintenance points are readily overlooked or neglected.

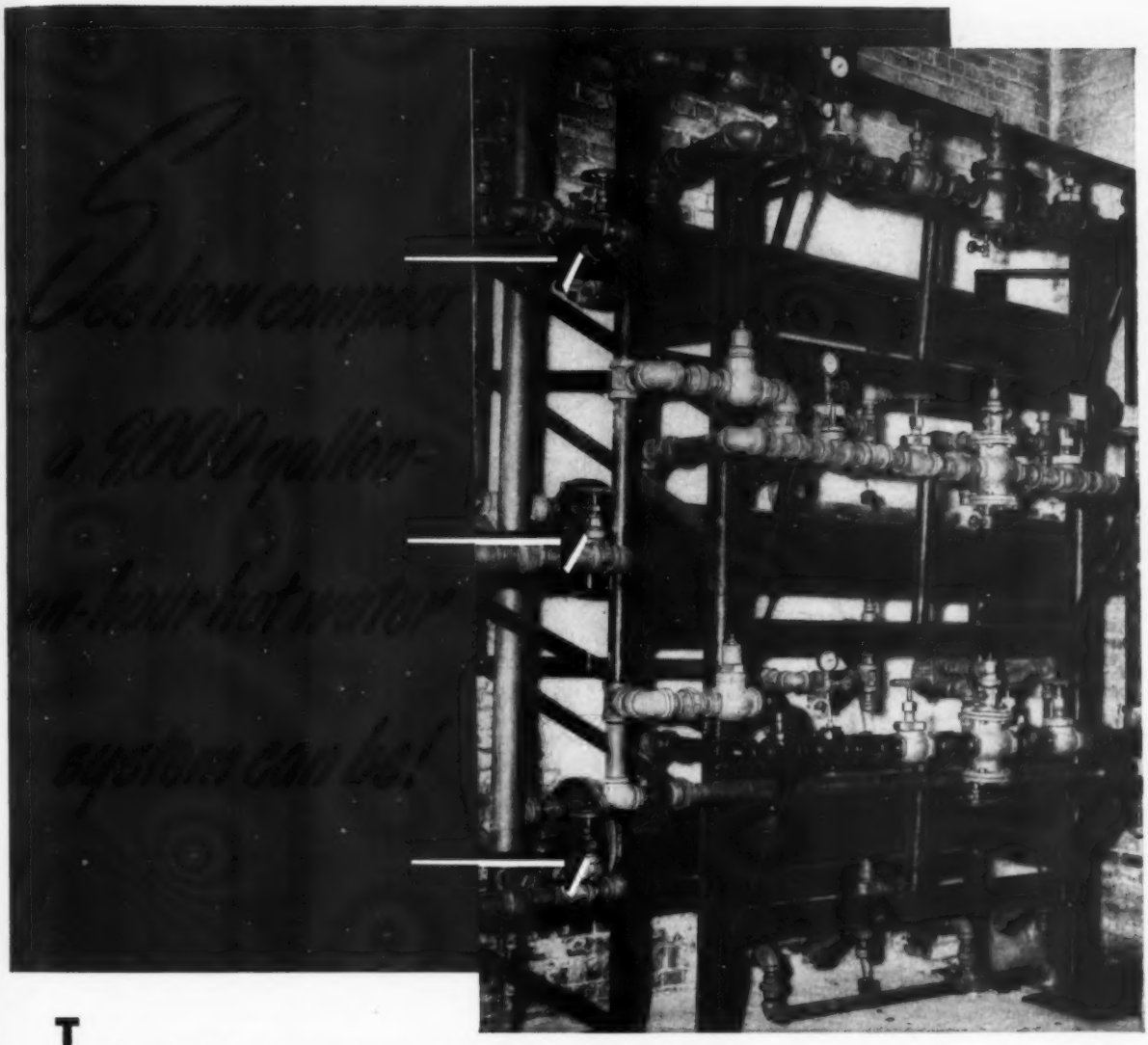
The speaker also stated that too many companies entrust the responsibility for upkeep of expensive equipment to an unskilled worker just graduated from the janitor classification. Frequently the ex-janitor is merely given an oil-can or grease gun, shown where to find the oil and grease, and turned loose among the equipment as a "lubrication engineer". As a result, the maintenance crew must follow him around the plant to replace bearings that have been skipped entirely, or have burned out from over-lubrication or from the wrong lubricant.

Mr. Sumner made a direct appeal to industry to raise the classification of the "oiler" or "grease monkey". Make the lubrication job, he said, so attractive that a higher class of maintenance men would be willing to go through an intensive training period and examination to determine their fitness to care properly for expensive production machinery. This plea was also seconded by Mr. Pritchard and other members of the panel. In discussing certain problems encountered in the lubrication procedures in his plant, Mr. Pritchard stated that selection of the highest caliber maintenance men available, those properly schooled in the art of precision maintenance and equipped with the necessary tools to do an efficient job, proved to be a ready answer to their difficulties.

Mr. Pritchard also pointed out that contamination of lubricants, due to improper methods of storage or handling, takes a tremendous toll in the operating costs of industry. As a means



This view was typical of all sessions; only a few vacant seats were to be found in the 1325-seat auditorium.



This battery of General Instantaneous Water Heaters (three No. 632's) shows how a leading tannery has modernized its hot water system.

THE INSTALLATION shown above delivers practically all the hot water required by a New England tannery . . . 9,000 gallons an hour, 40° to 180° rise, with steam at 6 lbs. pressure. It consists of three No. 632 General Instantaneous Heaters connected in parallel. Notice how little space it occupies . . . just a small corner of the boiler room.

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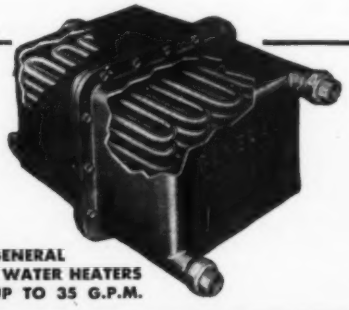

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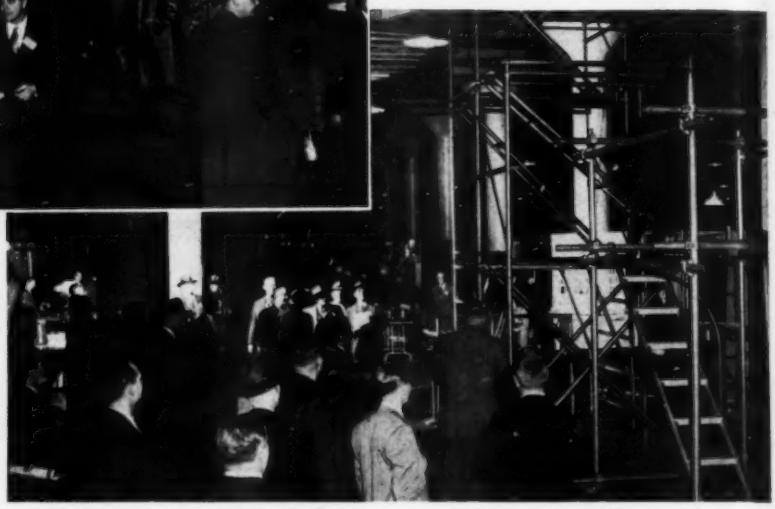


Visitors saw much of interest among the more than 100 exhibits. Group shown below are watching a demonstration of lightweight portable scaffolding, which was one of the maintenance items prominently displayed.

of closer control of this waste, the speaker urged greater use of transfer pumps and enclosed containers to permit transfer of oil or grease from the original container to bearings or gears with the minimum of exposure to outside contamination.

Remarks of the other speakers on the preventive maintenance panel were as equally relevant and informative. Questions from the interested audience would have kept the panel members on the rostrum all day if it were not for the rigid program schedule.

Costs

With maintenance costs skyrocketing as the result of increased mechanization throughout industry, the urgency for control measures and regulations of such expenditures came in for considerable discussion at the evening session on Monday, January 16th. This meeting featured prominent management consultants and engineers in this field and was under the chairmanship of W. K. Bailey, vice president, The Warner and Swasey Co.

Speaking on the subject, "How Much Does Maintenance Cost?" J. E. Sutherland, vice president, Detroit district, MacDonald Bros., Inc., said that American industry spent over 8½ billions of dollars on maintenance and repairs during 1948. This compares with expenditures of 5.4 billions and 7.2 billions in 1946 and 1947, repectively. Basing his opinions on the results of a recent survey of 1000 plants, Mr. Sutherland stated that many managements do not realize the full impact of maintenance expense, particularly the fact that the majority of companies spend annually an amount in excess of 12% of their net property valuation. Since maintenance is one of the few remaining outlets for curbing over-all operating costs, greater control over maintenance expenditures is possible, without sacrifice to equipment life and efficiency, if such activities are properly planned and budgeted.

Albert Ramond, president, Albert Ramond and Associates, presented numerous enlightening facts in his talk entitled, "How Much Should Maintenance Cost?" He said that no positive method was available todetermine just what maintenance costs should be in any specific plant. However, he did cite several case histories where costs were measured and actually reduced by the application of work measurement and direct incentives.

In comparing costs between plants of similar size and product, Mr. Ramond revealed that the maintenance payroll of a Chicago meat packing concern was 10% of the total after work measurement and incentives had reduced costs to the minimum. On the other hand, the maintenance payroll of an Iowa plant of equal product volume was only 5% of the total. As in this case, many intangibles— such as age and design of buildings and equipment—make direct comparisons impractical. True, many maintenance operations can be precisely scheduled and estimated in advance, but the hitch comes when unexpected breakdowns necessitate an indefinite amount of work.

Budgets

Factual data on "Budgeting the Maintenance Operation" were presented in a paper co-authored by two duPont engineers—L. A. Darling, supervisor of power, water, and maintenance; and R. W. Smith, maintenance consultant. Thev described in detail the several budget plans that have been in operation at different times in the du Pont company plants. Advantages and disadvantages of each method were given. The most common procedure, the authors said, is to base the budget upon a production index, i. e., an average maintenance cost per pound of product. Although in the use of this method adjustments are made for variations in labor and material costs, no allowances are possible for process changes, improved maintenance practices and tools, and other contingencies.

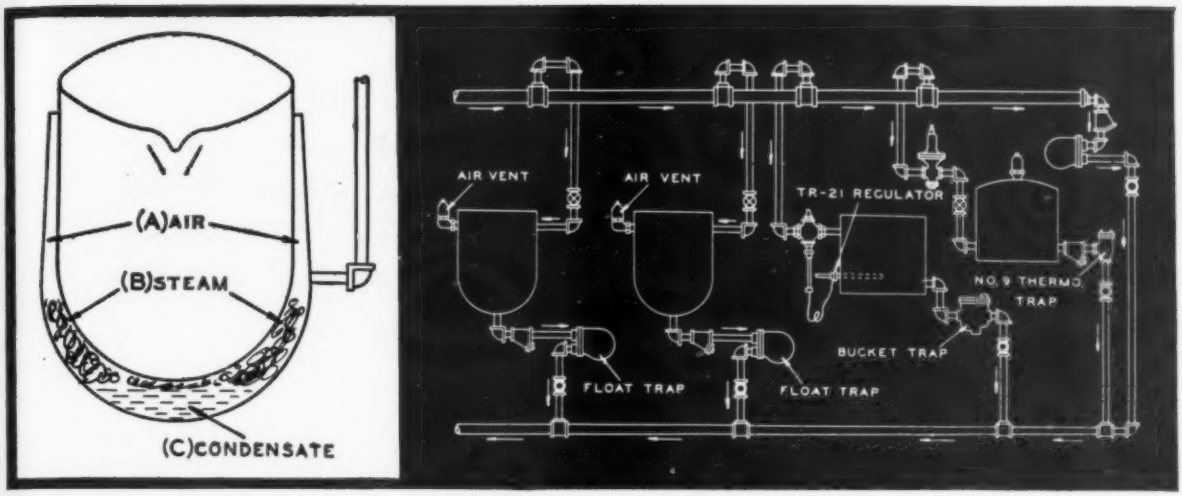
Another means of establishing the maintenance budget is to utilize the total machine operating hours as the governing factor. Similarly, kw hours of electricity have been used as the basis to a limited extent. Still another method is the formula budget, or one based on past experiences and judgment of qualified personnel.

The co-authors listed six principles to be followed in the establishment of a successful budget as: (1) get maintenance supervision to assist in the preparation of the budget; (2) budget separately the work which varies directly with production and that which does not; (3) base budget on a sound plan of what has to be done; (4) secure and maintain reliable records of equipment and costs; (5) aim at lowest manufacturing costs rather than lowest maintenance costs: and (6) a sound budget procedure fits well into a maintenance improvement program.

Organization

In discussing "Maintenance Organization and Management—Principles", C. C. Winston, senior staff engineer, Wallace Clark and Co., affirmed

(Continued on page 120)



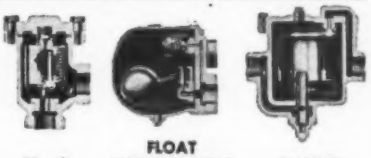
GOOD STEAM PRACTICE

Simple as ABC

A. Air and other gases in steam lines or equipment not only reduce the effective temperature of the steam, but create insulated cold spots wherever there is an accumulation. These gases are constantly generated in the boiler and air is always present when starting up. Ask for Bulletin No. 275 (Air in Steam).

B. Dry steam can be delivered at the point of use only by trapping condensate from mains, risers, coils, etc. The amount of steam and therefore the temperature of the room, process, press, tank or oven, can be controlled to within a degree or two by selecting suitable Sarco Temperature Controls.

C. The speed of the work can be maintained and fuel efficiency insured at top level by removing condensate with the right Sarco Steam Trap based on calculations and recommendations given in Sarco Bulletin No. 1600.



No. 9 — FLOAT THERMOSTATIC — BUCKET

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353

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Short News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Plan Gas Turbine to Operate at 2200° F

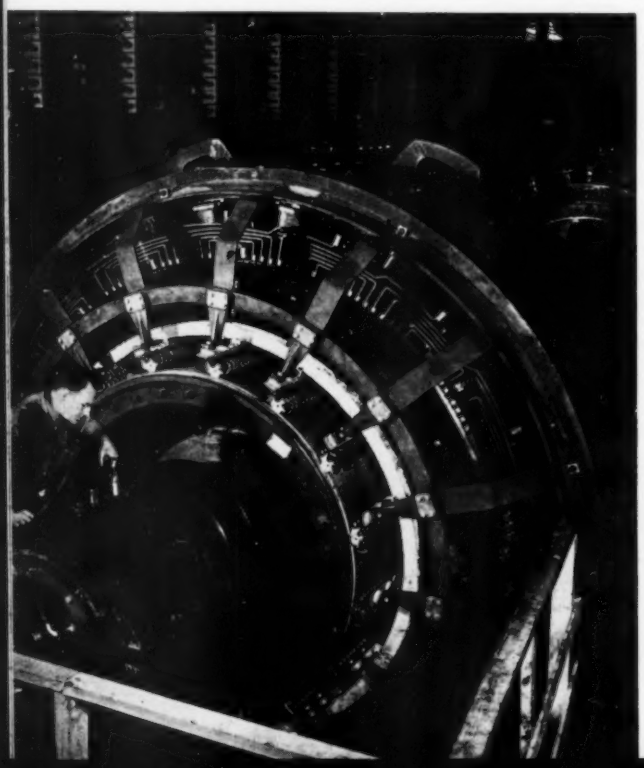
Plans for a 200 hp gas turbine with the important parts made of a recently introduced heat-resistant material is now under development by Kennametal Inc. The unit will be built and tested in their plant at Latrobe, Pa.

The new material, called "Kentanium", has a high resistance to oxidation, retains unusually great strength at elevated temperatures, withstands thermal shock, and has much less weight than conventional heat-resistant materials. Operation of a turbine constructed with this metal is feasible at 2200° F, and consequently much greater efficiency can be obtained. Maximum horsepower can be developed in a lighter, more compact unit than heretofore possible.

This project is under the capable direction of John McVeigh, who has had considerable experience in research and development work.

Twin 4000 hp Rolling Mill Drive Unit Ready For Final Test

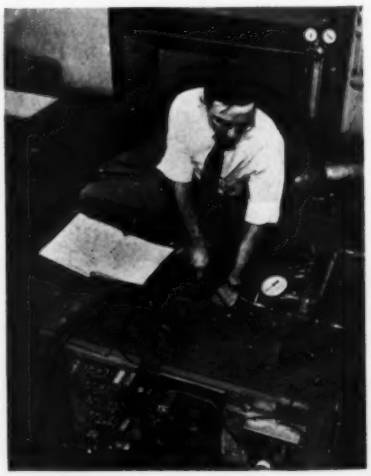
Twin drive unit, said to be the largest ever built for the steel mill industry, is being assembled at General Electric for final test. This reversing twin-drive unit will replace a 15,000 hp twin tandem, cross compound steam engine now in operation on the 206 in., 4 high mill located at the Lukens Steel Co., Coatesville, Pa. The new twin-drive will have a continuous torque rating of 1,400,000 lb-ft and a maximum torque rating of 3,850,000 lb-ft. The completed unit will consist of two 4000 hp, 30/75 rpm, 600 volt reversing motors. One motor will be direct connected to the top work roll while the other will drive the bottom work roll.



Compressed Air Drives Electrical Generator

Announcement has been made by the Case Institute of Technology that an electric generator driven with compressed air has undergone satisfactory final tests. The generator, developed by Robert I. Strough of the department of physics, contains no iron in its magnetic circuit. Brushes are liquid mercury, special cast copper acts as coil windings, and jets supplied with compressed air rotate a copper flywheel at 17,000 rpm.

Principle behind this unique generator is the rotating disc generator invented by Faraday in 1831. In an ordinary generator with an iron rotor, electrical energy is led through copper or carbon brushes rubbing on the rotor. However, the whirling disc in this generator is so large ordinary brushes would not handle the current without great loss. The problem was solved with jets of liquid mercury acting as brushes.



Jets of compressed air blowing against "buckets" cut into the whirling disc rotates the disc at speeds approaching 300 miles per hour. The generator has already developed a magnetic field 6,000 times as intense as that of the earth, and this performance appears to be far below ultimate capacity.

This type of machine generates a huge magnetic field at negligible cost, and Mr. Strough sees it applied as a possible magnetic core of a betatron or other atom-smash-

(Continued on page 112)

HERE'S YOUR *Complete* STEAM PLANT

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
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- 17 sizes from 20 to 500 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
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Sun products have been "Job Proved" in the lubrication of almost every type of mining, manufacturing, power, and transportation equipment . . . in refrigeration and air-conditioning . . . in metal cutting, tempering, and quenching . . . in the processing of textile fibers, leather, natural and synthetic rubbers . . . in the impregnation of electrical, electronic, and packaging materials of many kinds.

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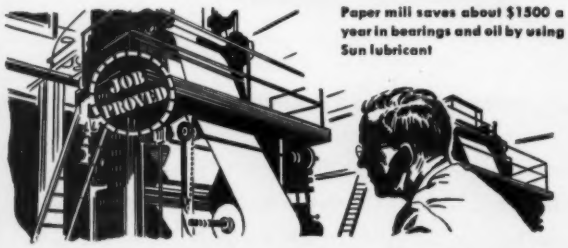
SUNVIS 900 OILS—High-viscosity-index, paraffinic-type oils—of uniform O F pour point—fortified against rust, corrosion, oxidation, and sludge. The finest available lubricant for turbines, hydraulic systems, and similar applications.

SUNVIS HD 700 OILS—High-viscosity-index oils containing additives which minimize oxidation and give detergency. Ideal lubricants for internal combustion engines subjected to continuous heavy loads under the most adverse conditions.

SUNVIS OILS—Solvent-refined paraffinic-type oils of uniform high viscosity index, low pour point, and low carbon content. Especially suitable for application to long-time use in all types of industrial reservoirs and circulating systems.

DYNAVIS OILS—Low-pour-point, high-viscosity-index, inhibited oils, containing an additive which helps prevent formation of harmful corrosive and sludge-forming acids. Well suited for engines fitted with alloy bearings and operated at high temperatures.



Paper mill saves about $1500 a year in bearings and oil by using Sun lubricant

SOLNUS OILS—Well-refined straight mineral oils. Stand up under hard use for long periods of time. Recommended for use in machine tools, air compressors, certain types of diesels, etc.

CIRCO OILS—Used for general lubrication of industrial machinery when straight mineral oils are required.

SUNTAC OILS—100%-petroleum products which have been compounded to increase their adhesiveness. Recommended for general lubrication of all machines subjected to sudden shocks and load reversals. Cling to the parts to be lubricated.

STEAM CYLINDER OILS—High flash and fire point lubricants for either saturated or superheated steam conditions and for worm-gear speed-reduction units.

SUN CAR JOURNAL OILS—Dark oils meeting A.A.R. Specifications. For use in waste-packed bearings of railroad equipment.

SUN DELAWARE OILS—Dark oils for general lubrication on older types of industrial machinery.

SUNOCO WAY LUBRICANT—For use on tableways. Eliminates chatter and scoring . . . resists corrosion. Has good metal-wetting and adhesive properties, ample viscosity, and E. P. qualities.

SUN MARINE ENGINE OILS—Compounded with special emulsifying agents in order to provide adhesion to, and lubrication of, working parts in the presence of water. For the lubrication of bearings, eccentrics, crossheads, and various other parts of steam engines.

ROCK DRILL OIL—High-film-strength adhesive oil. For use in jackhammers, stopers, drifters, and similar equipment.

INDUSTRIAL GREASES

SUN CUP GREASES—Water resistant. For grease-cup and grease-gun application when service is normal.

SUN GUN GREASES—Smooth greases made with medium-viscosity oil. Stable under pressure in power and booster guns.

ADHESIVE PRESSURE GREASES—Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES—For power-driven central grease lubricating systems in heavy industries. Also used as a "medium cup grease."

SUN MINE CAR GREASES—Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity-type wheels.

SUN MINING MACHINE LUBRICANT—Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

Chemical plant saves about $8000 per year by adopting Sun Pressure Grease

SUN ROLLER BEARING GREASES—For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS—Black adhesive open-gear compounds and

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SUN PETROLEUM

SPEED PRODUCTION, IMPROVE QUALITY

wire-cable greases. Recommended for power presses, mining machinery, worn reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND—For crawler-type tractors. Provides good lubrication with exceptional sealing qualities.

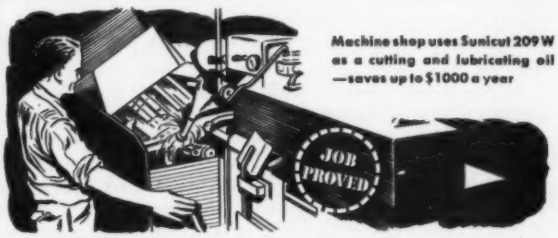
METALWORKING OILS

SUNICUT—Straight (non-emulsifiable) transparent cutting oils. Recommended for automatic screw machines and heavy-duty machining operations. Permit high speed production with excellent finishes, long tool life.

SUNOCO EMULSIFYING CUTTING OIL—A self-emulsifying oil which produces a stable white emulsion. Efficient and economical cooling and lubricating medium for turning, milling, drilling, and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant.

SUN QUENCHING OILS—Specially refined oils designed to aid development of maximum physical properties in a wide variety of steels.

SUN TEMPERING OILS—Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.



Machine shop uses Sunicut 209 W as a cutting and lubricating oil —saves up to $1000 a year

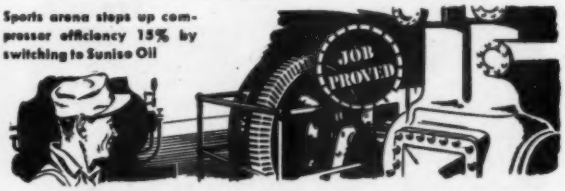
SUN ROLLING OILS—Straight and emulsifying oils which will permit maximum production in rolling steel, aluminum, brass, and copper.

SUN ANTI-RUST COMPOUNDS—Petroleum-base oils with chemical additives designed to prevent the rusting and corrosion of steel.

REFRIGERATION OILS

SUNISO REFRIGERATION OILS—Have extremely low pour points, extremely low wax-separating characteristics, a high degree of stability and long life. Initially neutral and resistant to formation of detrimental acids under service conditions. Suniso Oils are high quality oils suitable for both high- and low-temperature operations. The most widely used oils in refrigeration and air-conditioning.

Sports arena steps up compressor efficiency 15% by switching to Suniso Oil



TEXTILE-PROCESSING OILS

SUNOTEX TEXTILE OILS—Designed to impart certain additional properties to various forms of fibers during their processing from the fiber state into a manufactured product. All Sunotex textile oils are emulsifiable in water. Highest rating in fadometer tests.

SUN COTTON CONDITIONING OILS—Pale mineral oils which condition the cotton. They prevent waste by cutting down excessive amounts of "fly" (fine air-borne lint particles).

Worsted mill obtains easier scouring, better quality, larger yield with Sunotex WO-220

SUN ASBESTOS FIBER CONDITIONING OIL—Used for spraying on the asbestos during processing. Fibers are kept from being damaged or broken down, and harmful dust is minimized when this product is used.

SUN CORDAGE OILS—Generally used alone, but are adaptable to various formulas used by cordage manufacturers. Selected products, highly compatible with additives.

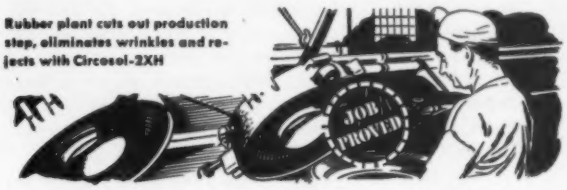
RUBBER-PROCESSING AIDS

CIRCOSOL-2XH—An elasticator and processing aid for natural rubber and especially for GR-S. Outstanding for sponge rubber.

CIRCO LIGHT PROCESS AID—A processing agent and excellent softener for natural rubber, natural rubber reclaims, and neoprene synthetic rubber. Used for GR-S to some extent.

SUNDEX-53—An inexpensive product suitable for processing GR-S and blends of GR-S and natural rubber. An established processing aid for rubber footwear stocks and semihard rubbers.

Rubber plant cuts out production step, eliminates wrinkles and rejects with Circosol-2XH



CIRCOMAR-5AA—A black-colored product for processing natural and GR-S rubber used in tire-making. Also used in reclaiming natural-rubber scrap. Replaces asphalt fluxes. Free-flowing at room temperature.

WAXES

Sun's new wax plant was completed in 1949. Its many refining innovations and extreme flexibility permit new types of waxes to be manufactured in large quantities—a procedure heretofore impracticable. A wide range of fully refined paraffin and microcrystalline waxes will be "tailor-made" to meet the requirements of virtually all major industrial applications. Pilot plant samples of several grades are now available.

MISCELLANEOUS INDUSTRIAL PRODUCTS

SUN SOLVENTS—Sun Spirits for the thinning of paints, varnishes, and enamels, and for metal-cleaning . . . a pure, water-white petroleum solvent free of corrosive sulphur. Other Sun solvents with special properties are available for the chemical industry.

SUN LEATHER OILS—Mineral-base leather oils. Used for obtaining the desired tensile strength, proper temper, and controlled moisture content. Maintain a light even color . . . mix well . . . distribute evenly.

"JOB PROVED" IN EVERY INDUSTRY

PRODUCTS

SUNOCO

(Continued from page 108)

ers. Adapting such a machine for atomic development could save thousands of dollars worth of energy-storing equipment and would eliminate rooms of condensers, and costly magnets, which are the bulk of most atom smashers.

Limiting factor in the unit's capacity is the speed at which the disc will rotate before rupture. The experimental model was surrounded by a heavy barrier of timbers and steel to prevent an accident should the disc shatter. Special equipment was also required to dispose of the poisonous mercury vapors developed.

Aluminum Gas Line Will Be An All-Welded Line

Construction has started on the first underground aluminum gas line to be installed in the nation. The line, an all-welded section, will extend approximately 1.8 miles from the main trunk line of the Alabama-Tennessee Natural Gas Company to the Listerhill, Alabama, Plant of Reynolds Metals Company. The line owned by the Alabama-Tennessee Natural Gas Company will be laid by Lehman Hoge & Scott of Sheffield, Alabama.

Aluminum alloy extruded pipe measuring 8⅝ in. outside dia, with a wall thickness of ¼ in., will be installed. Design working pressure is 200 psi with a bursting pressure of 1750 psi.

Pipe will be received on the site in 40 ft lengths and be joined by straight butt welds. Pipe ends will be prepared for welding at the mill by making a 30° bevel, and no field preparation will be necessary. The weld will be made with two passes, using 3/16 in. dia 5% silicon type aluminum rod. No flux will be employed. Furthermore, a complete shield of inert gas is provided around the weld zone, pro-

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...you get them ALL from WEINMAN

Your WEINMAN representative is the man to talk to about your pumping requirements. He knows pumps—from "wire to water." He knows about their application, installation and maintenance. He is backed up by an organization where every department head has had at least twenty-five years' experience with ONE product—Centrifugal Pumps.

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WEINMAN Type "U" Non-Clogging Pumps
For liquids carrying solids.
Capacities from 100 g.p.m. to 2,300 g.p.m.
Heads to 105 feet.

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Full of applications, specifications and engineering data that will help solve your grating problems

Send for your copy TODAY WHATEVER your grating problem ... flooring, catwalks, stair treads, bridge surfacing, sidewalk doors, subway gratings, or any of the hundred and one uses for any industry ... you'll want this big new Bulletin for complete information on construction details and *all* the advantages of Blaw-Knox Steel Gratings. Ask for Bulletin 2296.

BLAW-KNOX DIVISION
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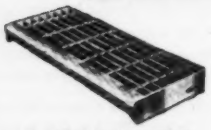
BLAW-KNOX ELECTROFORGED STEEL STAIR TREADS



Designed for tremendous strength against impact. Available with rolled diamond checker plate nosing (illustrated); twisted crossbar nosing; or abrasive nosing.

BLAW-KNOX ELECTROFORGED STEEL GRATING

tecting the weld and surrounding metal from the action of the atmosphere. Welding will be accomplished with a 300 amp portable gasoline-engine driven welder operated at full output.

Wrapping of the entire pipe line, including welded joints, will be made with pipe wrap, supplied by Dearborn Chemical Company. For experience purposes, a 40 ft section will not be wrapped to determine if wrapping is necessary. This particular section will be installed with a by-pass that will be wrapped. Valves will be installed to disconnect the unwrapped section from the line at any time to allow gas to flow through the by-pass.

Plans call for inspection of the unwrapped section of the line at six-month intervals. Some experimental work already completed has indicated that the wrapping of the aluminum pipe may not be necessary. In addition a careful installation cost analysis is to be made to furnish factual information for comparison with other types of pipe lines. Economies in installation and maintenance are expected to offset any differential in material cost.

Diesel to Operate On Gas Produced from Sewage Sludge

Announcement has just been made of the shipment of an 8 cylinder, 14½ x 20, supercharged, 1440 hp, dual-fuel Diesel engine to the City of Columbus Sewage Treatment Plant, Columbus, Ohio by the Superior Engine Division of the National Supply Company. The new unit will be installed at Franklin Township sewage treatment plant, Franklin County, Ohio. Gas produced from sewage sludge or natural gas and fuel oil in any proportions ranging from 10% through 100% will be employed for fuel.

Installation of the new engine is to be completed by

(Continued on page 174)

Invitation to a BIG BLOWOUT!

Plant operators: Celebrate the swift departure of *Dirt, Dust,* and *Grit* from your machinery and equipment. BLOW these trouble makers OUT of every crack and crevice with a powerful CLEMENTS-CADILLAC combination BLOWER-SUCTION tool. Use it regularly to clean motors, generators, switchboards, woodworking machinery, tool bins, stock bins, etc.

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No 2 HEAVY-DUTY
1/8 TO 2
If this Housing ever Breaks or Distorts we will replace it Free

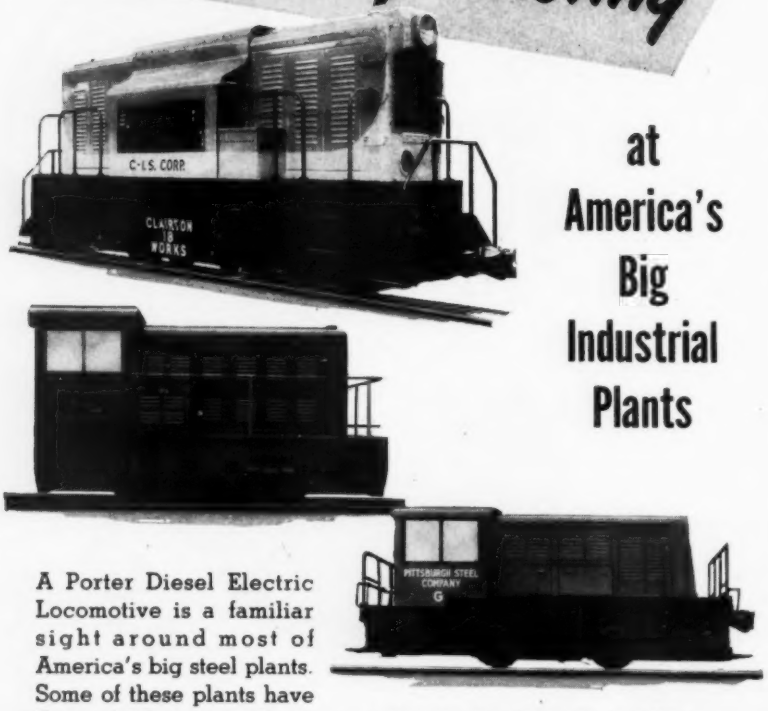
RIDGID Cutters roll right through all kinds of pipe and conduit

● It's really a cinch to cut pipe extra fast with the popular efficiency-balanced RIDGID cutter. Thin heat-treated tool-steel blade leaves practically no burr. Every cutter factory-tested to make sure it tracks perfectly. Your choice of five sizes to 6" pipe; four-wheel cutters to 4." Choose the favorite of men who know fine tools — buy RIDGID cutters at your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

PORTER LOCOMOTIVES

Keep Things Moving



at America's Big Industrial Plants

A Porter Diesel Electric Locomotive is a familiar sight around most of America's big steel plants. Some of these plants have fleets of 15 or more Porters, ranging in size from 20 to 100 tons. Porter has been making industrial locomotives for eighty-four years. In those eight-four years, many large industrial concerns have become steady customers of the Porter Company, placing order after order for Porter Locomotives for replacements or additions to their fleet.

Porter engineers will be glad to survey your switching requirements and submit specifications for a standard or, if necessary, a special unit designed to your individual requirements. A Porter engineer can show you how to cut your switching costs.

PORTER BUILT means "Better-Built"

H. K. PORTER COMPANY, Inc.
PITTSBURGH 1, PENNSYLVANIA
District Offices in Principal Cities

PORTER "Better Built" Equipment Established 1866

Lubrication

(Continued from page 77)

5—Steam Cylinder Oil Consumption Chart for Corliss, poppet valve and slide valve engines
6—Compressed Air Societies' rates for feed recommended for air compressor lubrication
7—S.A.E. number designations for motor oils
8—S.A.E. number designations for transmission oils
9—A.P.I. grading of motor oils
10—A.P.I. grading of transmission oils
11—Temperature viscosity chart
12—Methods of installing shaft and wick oilers
13—Catalogs on lubricating devices.

Through Supervision, Surveying, Selecting, and Servicing, the high standards of lubrication at the Koehring Company can only result in the ultimate goal—lower production costs—and records are already showing that to be the case.

Condensers

(Continued from page 86)

por binding, fluctuating hotwell level, and lack of minimum flow control through auxiliaries are disadvantages which often appear in uncontrolled systems.

Throttling control consists of a float actuated valve in the pump discharge line (Fig. 6A). Variation in hotwell level opens or closes the control valve, and the condensate pump operates on its normal head-capacity curve at all times. This eliminates much cavitations and a nearly constant level in the hotwell is maintained. Of course, frictional losses in the discharge line are increased by the presence of the throttling valve. In addition a more extensive piping system is required and a danger exists of overheating the condensate when the control valve is closed or nearly closed. As can be seen from Fig. 6A, condensate flow to auxiliaries such as oil coolers, inter- and aftercondensers, and generator air coolers varies with hotwell level. In some plants uneven flow is undesirable, and under this condition recirculating control is installed.

Recirculating control valve (Fig. 6B) is mounted on the float chamber, and the condensate passes through the auxiliaries before being returned to the hotwell. The condensate pump flow rate varies between the normal and maximum capacity of the recirculating valve. The hotwell level varies considerably; under certain conditions normal submergence will be maintained; under others, only a minimum

(Continued on page 118)

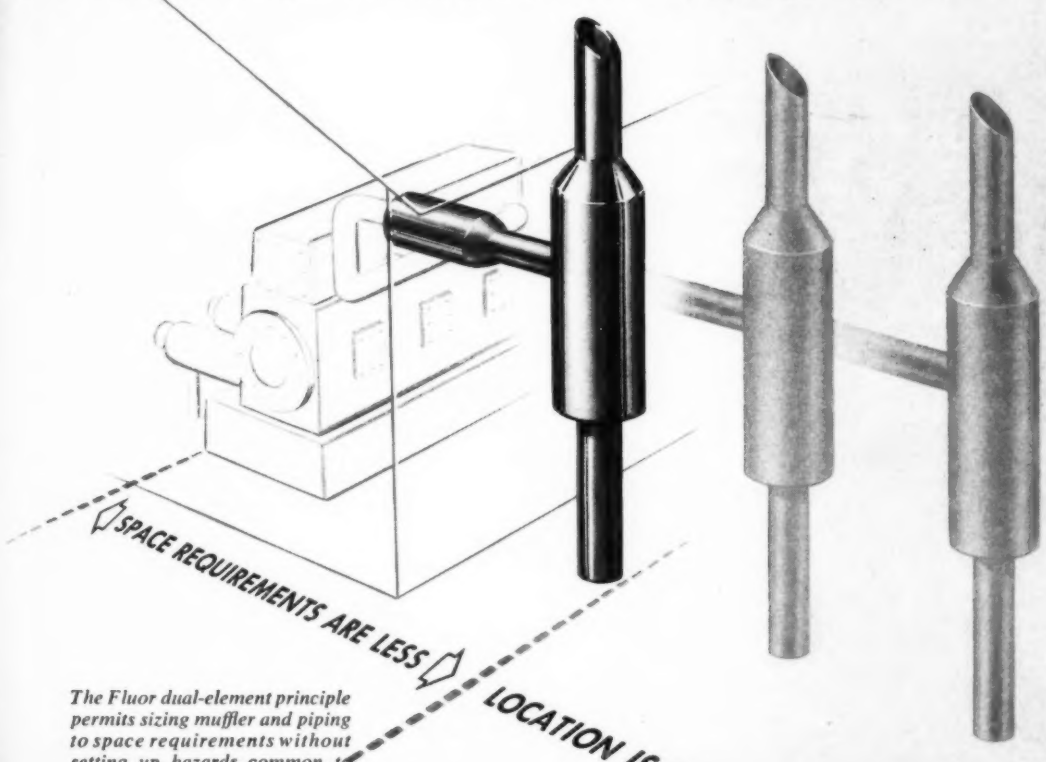
See for yourself...

the installation advantages of a FLUOR SERIES "D" MUFFLER SYSTEM

NO LONGER is ultimate muffling efficiency dependent upon trial-and-error locating of exhaust piping. With the Fluor Series "D," exhaust piping can be of *smaller* diameter, location of outside exhaust chamber *flexible* without affecting pressure drop or noise attenuation and pulsation reduction efficiency.

The reason lies in the unique dual-element design of this muffler *system*. Work is started on pulsative exhaust gases *at* the engine—noise and pulsation reflections are virtually eliminated *at* their source. The Fluor Series "D" Muffler is a *system* that incorporates *two* muffling elements—a primary element located in the immediate proximity of the engine and a secondary element located *at any desired spot* outside the engine room.

The Fluor Series "D" Muffler System is the answer to your muffling problems. In addition to installation flexibility it provides the highest muffling efficiency obtainable—*at a cost competitive with conventional mufflers.*



The Fluor dual-element principle permits sizing muffler and piping to space requirements without setting up hazards common to single-element mufflers.

All elements, including interconnecting piping, are engineered to a minimum in diameter.

Because muffling is spread throughout a Fluor Series "D" System, the outside muffling chamber can be set at any desired distance from the engine room wall.

AVAILABLE FROM STOCK—A Fluor Series "D" Muffler System to fit virtually any 2- or 4-cycle, 200 to 2400 HP diesel engine is available from stock. You need only submit engine room design and dimensions, make, model and RPM of engine and whether muffling system is to be air-cooled or non-air-cooled. Inquiries will be answered promptly.

THE FLUOR CORPORATION, LTD.

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MANUFACTURERS of Mufflers, Pulsation Dampeners, Gas Cleaners, Cooling Towers and Fin-Fan Units.

DESIGNERS AND CONSTRUCTORS of Refinery, Natural Gas and Chemical Processing Plants.

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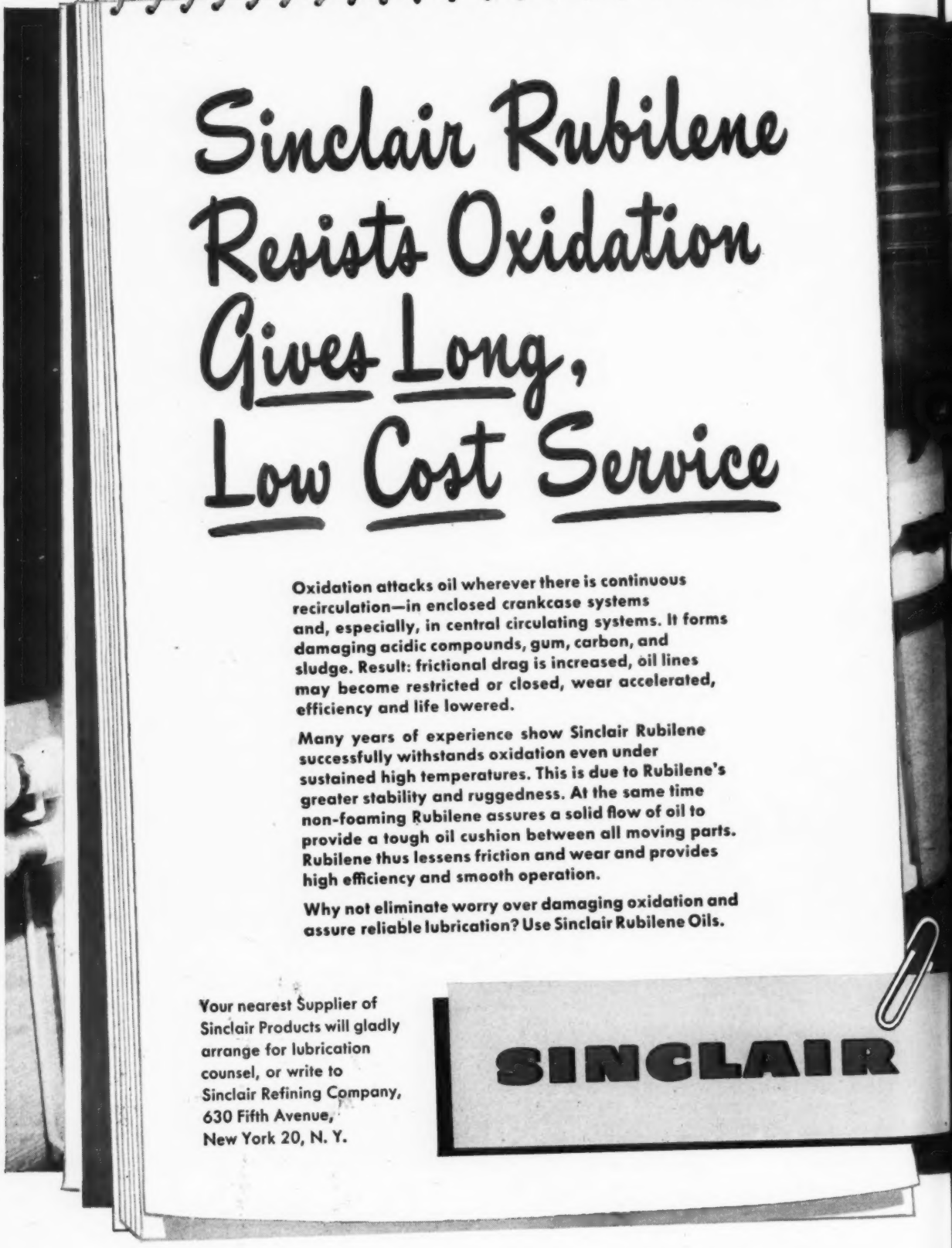
Offices in principal cities in the United States

Represented in the Sterling Areas by: Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.1., England



Sinclair Rubilene Resists Oxidation Gives Long, Low Cost Service

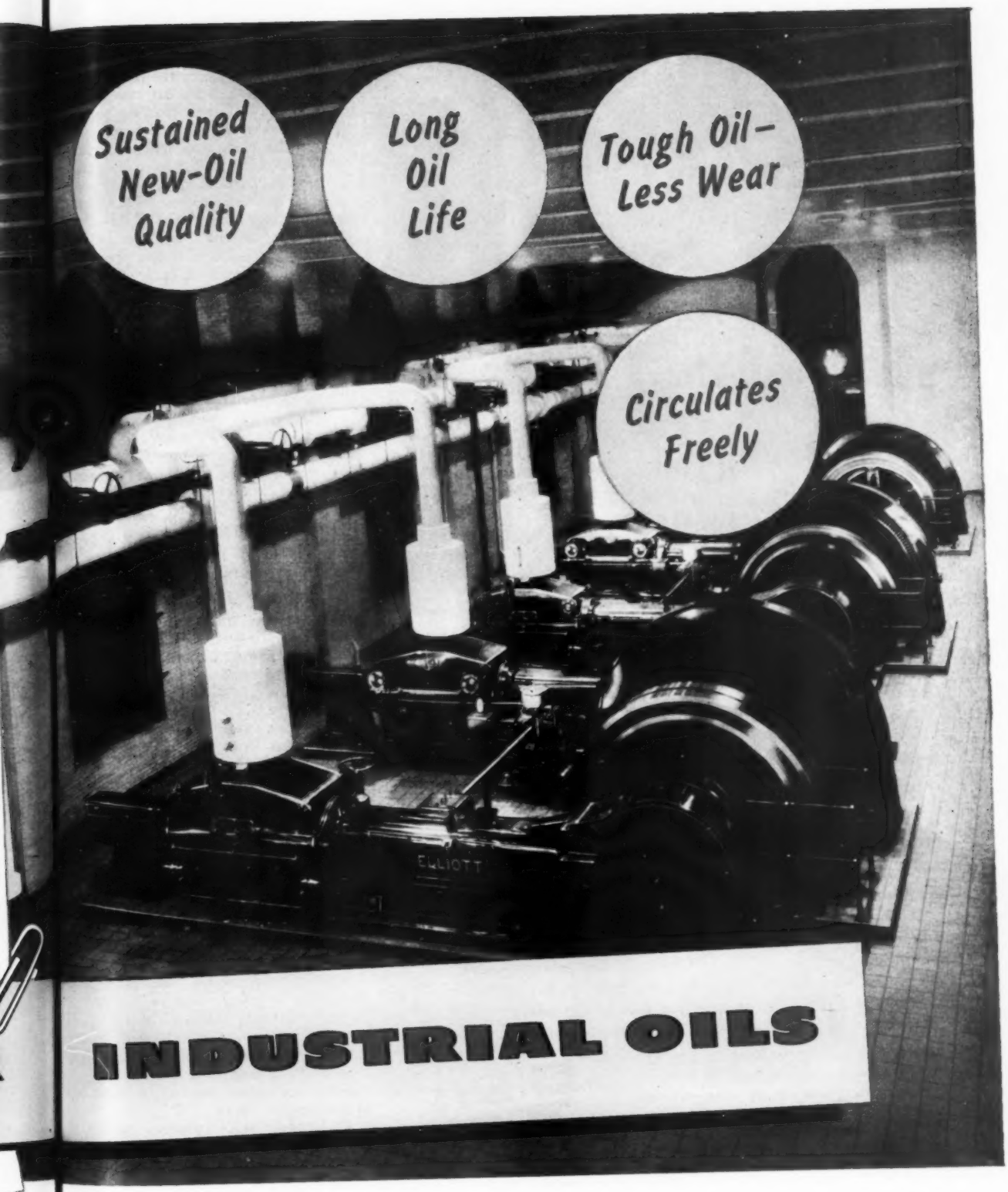
Oxidation attacks oil wherever there is continuous recirculation—in enclosed crankcase systems and, especially, in central circulating systems. It forms damaging acidic compounds, gum, carbon, and sludge. Result: frictional drag is increased, oil lines may become restricted or closed, wear accelerated, efficiency and life lowered.

Many years of experience show Sinclair Rubilene successfully withstands oxidation even under sustained high temperatures. This is due to Rubilene's greater stability and ruggedness. At the same time non-foaming Rubilene assures a solid flow of oil to provide a tough oil cushion between all moving parts. Rubilene thus lessens friction and wear and provides high efficiency and smooth operation.

Why not eliminate worry over damaging oxidation and assure reliable lubrication? Use Sinclair Rubilene Oils.

Your nearest Supplier of Sinclair Products will gladly arrange for lubrication counsel, or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

SINCLAIR


Sustained New-Oil Quality
Long Oil Life
Tough Oil– Less Wear
Circulates Freely
ELLIOTT
INDUSTRIAL OILS

(Continued from page 114)

of condensate will be in the hotwell. Recirculating control reduces cavitation, but the cavitation will not be entirely eliminated. However, the control does prevent overheating of the condensate pump and reduces the extreme variations in hotwell level that are sometimes found in uncontrolled systems.

This discussion has indicated that the ideal control system combines the advantages of throttling and recirculation. Such an arrangement has a throttling control valve in the pump discharge line beyond the recirculation takeoff. The combined system prevents cavitation, maintains a fairly uniform level in the hotwell, prevents pump overheating, and keeps auxiliaries supplied with sufficient condensate.

When selecting a control system for condensate pumps the various advantages and disadvantages summarized here form a good basis for decisions. In general, the combined system is best, but the costs are more and often cannot be justified in small jobs.

Various phases of steam jet air ejector and atmospheric relief valve application will be discussed in the third article of this series.

Boiler House

(Continued from page 89)

with production methods in the average industrial plant. Establishment of unit steam, power, air, and water costs of the products manufactured is an important function which should have its place in the cost accounting system.

When is a steam generating facility obsolete? A brief answer might be when the present equipment as a working unit, or in part, fails to produce economically; when it can no longer be depended upon; when its use is no longer safe; and when standby capacity is no longer available.

Opinions on the expected life of a boiler, for example, are numerous; nevertheless, a medium pressure stationary boiler and setting with average maintenance will render 30 years of service. Associated equipment—such as pumps, heaters, and fans—will give from 20 to 30 years of service with good care. Many plants today have old boilers and auxiliary equipment that are not only inefficient, but a constant source of care, and a steady threat to production continuity because of outages for repair.

Executives, plant engineers, directors or owners of establishments in which steam, power, air, and water are required, should frequently and thoroughly investigate the condition of the boiler plant and ascertain the possible savings which may be associated with that important department.

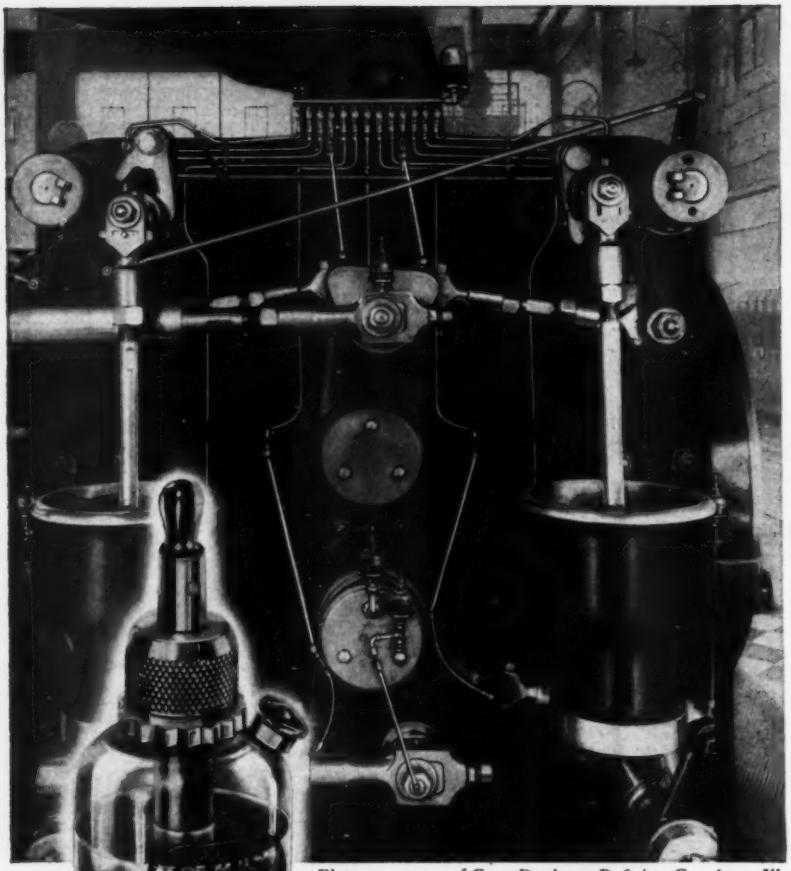
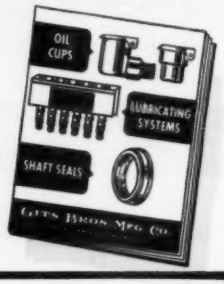


Photo courtesy of Corn Products Refining Co., Argo, Ill.

"WE CAN DEPEND ON GITS OILERS"

That's the experience of Corn Products Refining Co. and many other leaders of industry. It's vital for these companies to avoid costly machine down-time. They know that: (1) Burned-out bearings due to faulty lubrication are a major cause of down-time. (2) Gits oilers eliminate faulty lubrication. (3) Gits oilers help achieve the important benefits of uninterrupted machine performance: maximum production . . . no wasted lubricant . . . less power consumption. That's why, for the past 40 years, industry has looked to Gits oilers and and lubricating systems . . . for *dependable, proper* lubrication, with very low costs of installation and maintenance.

FREE LUBRICATION ENGINEERING SERVICE by Gits Engineering Staff, backed by 40 years of experience. Submit your problem—receive prompt recommendations. No obligation. **WRITE TODAY FOR THIS FREE BOOKLET** describing in detail the full Gits line of the most modern oilers and lubricating systems.



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OR XYLOPHONES

AIR BY "Buffalo" HELPS YOU DO IT BETTER

NEED humidity control to halt rust? Looking for a cheaper way to convey materials? Want to remove corrosive gases from a continuous process? Striving for a better product and more of it? Better industrial relations? Lower accident rate? All these and many other air jobs are being done throughout industry by "Buffalo" Fans and Air Conditioning Units. "Buffalo" units will work quietly, day and night, in your plant — removing impurities, tempering, ventilating, cooling or heating — providing the atmosphere in which your product and your personnel can be at their best.

BUFFALO FORGE COMPANY

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"Buffalo" FANS AND AIR CONDITIONING

Branch Offices in All Principal Cities

AIR CONDITIONING — OR SIMPLE VENTILATION?

"Buffalo" Air Conditioning Units can create and maintain literally any "climate" your plant requires—efficiently and at a very reasonable operating cost. Above, an air washer removes dust and humidifies a large plant. Many "Buffalo" Air Washers have been continuously on the job for over forty years.

A good, reliable fan like this "Buffalo" Limit-Load model might well provide all the cooling and general air comfort for your plant needs—when other air processing is not called for. Many "Buffalo" Fans have been on the job for forty, fifty and more years. The "Buffalo" line is COMPLETE—to suit any budget, any requirements.

YOUR NEARBY "BUFFALO" ENGINEERING REPRESENTATIVE will give you recommendations — based on your problem and your budget — on turning your plant air to profitable use. He's a Graduate Engineer with 1-5 years of factory training. He's yours to call on, with no obligation.

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IT PAYS IN MANY WAYS
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Maintenance Show

(Continued from page 106)

the importance of planned maintenance programs and the vital part they play in cost reduction. He set forth the following fundamentals of a good organization: (1) equipment records; (2) inspections; (3) lubrication; (4) job orders; (5) planning; (6) sizing the maintenance force to the job at hand; (7) job order costs; (8) equipment maintenance costs; (9) maintenance stores; (10) salaries and wages; and (11) reports to management.

At the same session, J. B. Whitlock, general maintenance engineer, Armco Steel Corp., gave an interesting description of the breakdown of maintenance activities in his company's plants. G. E. Keck, superintendent of work analysis, United Air Lines, followed with a discussion of the organization and operation of United's large maintenance base at San Francisco.

Building Upkeep

Repairs and upkeep of factory buildings and housekeeping practices came in for their share of the spotlight. W. P. Sheehy, maintenance engineer, and T. C. Richards, manager,

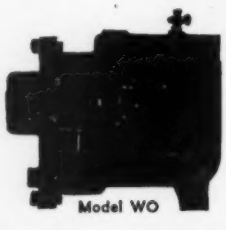
(Continued on page 122)

Enormous DRAINAGE CAPACITY of Nicholson

PISTON-OPERATED SUPER-TRAP

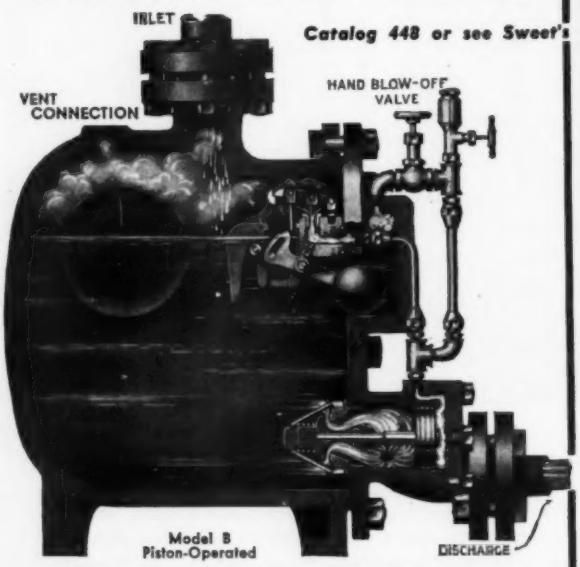
DISTINGUISHES IT IN POWER SERVICE

With valve orifices up to 2" diam., Nicholson piston-operated steam traps offer unsurpassed drainage capacity. Universally specified for draining steam purifiers in power plants, where thousands are in use; discharge large volumes of water almost instantly. Increasingly installed wherever water and dirt in volume are a problem: superheated steam lines, headers, separators, heaters. Other features: won't leak even if cooked dry; rugged; working parts of stainless steel. Press., 2 to 650 lbs. The lowest price large-capacity trap.



Model WO

NICHOLSON WEIGHT-OPERATED TRAPS (left) — Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.



Model B Piston-Operated

Catalog 448 or see Sweet's

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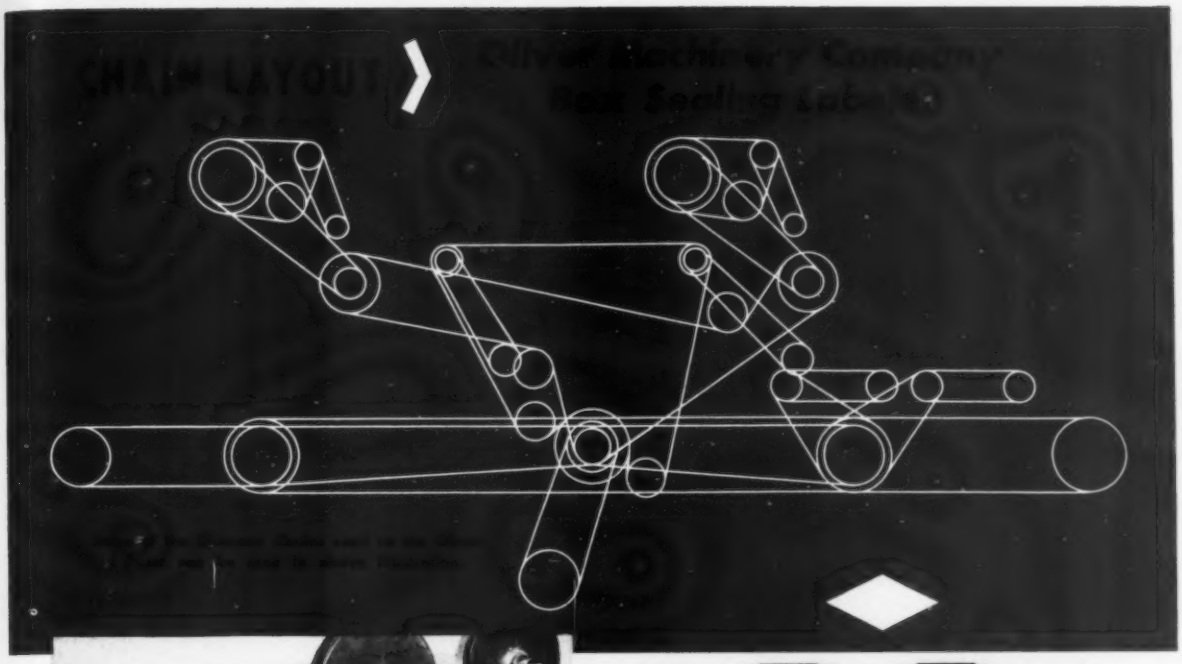
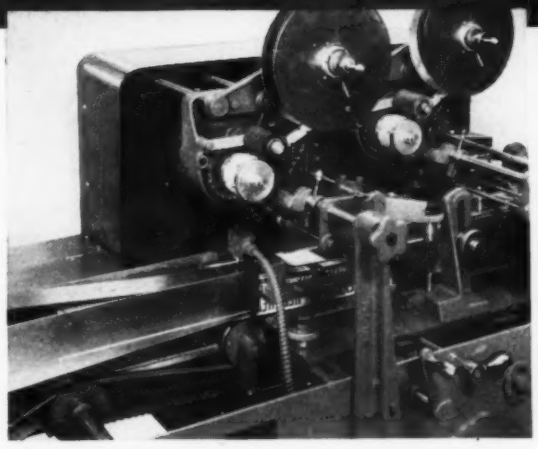
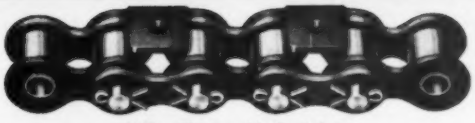
Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves.







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Roller Chain with Extended Pins

Diamond Standard Roller Chain

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HIGH OUTPUT AND ACCURACY MAINTAINED

●There are 28 widely separated shafts operated at various speeds and in clockwise and anti-clockwise directions on the Oliver Automatic Labeler.

Steady high output of automatic machinery is a necessity in this day of packaged products. Accuracy of timing, coordination of the various motions, and uninterrupted operation are secured through the use of Diamond Roller Chains.

If you use or build automatic machinery, you find it pays to insist on DIAMOND Roller Chains. Practical suggestions from our specialized engineering staff are yours for the asking. Write for Chain and Sprocket Catalog No. 709.

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DIAMOND **ROLLER CHAINS**

Pressure Reducing Costs

No. 227
For Water and Air Service

When You Use Masoneilan Regulators

You'll find thousands of Masoneilan Regulators in hundreds of plants giving accurate pressure reducing service in various types of application. For instance, the No. 227 regulator, illustrated, accurately maintains uniform industrial water pressures.

It stops "singing" and splashing from fixtures without cutting down flow . . . reduces strain on plumbing. In addition, the rugged construction assures long operating life with minimum maintenance. Body Ratings: 150 psi . . . Reduced Pressure Ranges: sizes ¼" to 1"—10-60 psi; sizes 1¼" to 1½" — 10-40; 30-60 psi; size 2" — 15-40; 30-60 psi.

Also available for air service in sizes from ¼" to 1".

Your local Mason-Neilan industrial distributor is ready to serve you from his stock

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(Continued from page 122)

elevator operation, maintenance, and plant cleaning, The B. F. Goodrich Co., presented many helpful pointers on the care of roofs, walls and floors, and on the painting and cleaning of industrial plants. For cleaning operations and other phases of maintenance work, the Goodrich engineers stressed the need for more widespread adaptior of "premixing" principles (the compounding and blending of necessary agents to satisfactorily perform or effect certain desired results) to attain economy, job standards, and safe results.

Sanitation

J. L. Barron, sanitary engineer and manager of sanitation department, National Biscuit Co., described practices in the food industry that have placed that industry far ahead of others in the matter of good housekeeping. In urging greater recognition to sanitary working environments throughout industry, Mr. Barron predicted that as wage scales level off and the battle for pensions waxes and wanes, labor unions will give increasing attention to those aspects of industrial sanitation which contribute to employe comfort and morale.

The ever-important topic of motor, control, and distribution equipment maintenance was capably handled by H. E. Hardenbrook, general works engineer, Buick Motor division, General Motors Corp. The use of electrical instruments in maintenance work was discussed by R. J. Teetsell, meter division instrument specialist, Westinghouse Electric Corp.

"Selection and Upkeep of Lighting Equipment" was the subject of R. M. Smart, division engineer, Sylvania Electric Products Co.; and the "Relationship of Lighting and Color to Production", by C. E. Egeler, illuminating engineer, General Electric Co., Nela Park, was received with more-than-usual interest.

Other interesting papers rounded out the program. They included: "Application of Service Equipment" by S. Senko, power house engineer, Personal Products Corp.; "Protecting the Plant Worker" by H. E. Beaven, engineering manager, New England division, American Mutual Liability Insurance Co.; and, last but not least, "Importance of Maintenance to Safety" by H. M. Erickson, safety director, Nash Motors division, Nash-Kelvinator Corp.

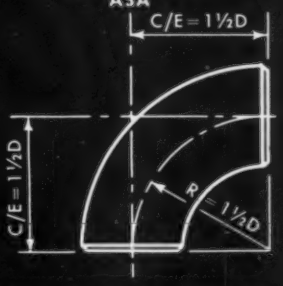
The Cleveland Engineering Society was dinner host to the show visitors on Wednesday evening. R. V. Mitchell, chairman of the board,

(Continued on page 124)

Improvements and economies in welded piping result from this *Variety* of MIDWEST ELBOWS

1

LONG RADIUS ASA

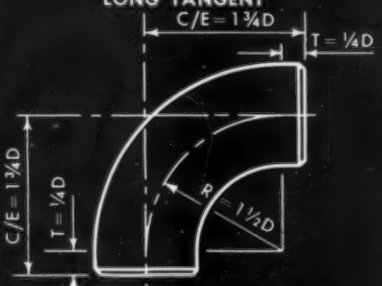


SIZES: ¾" TO 24", INCLUSIVE

Dimensions conform to applicable size range of American Standard for Butt-Welding Fittings, ASA B16.9. Radius and center-to-end dimension equal 1½ times nominal pipe size.

2

LONG RADIUS LONG TANGENT

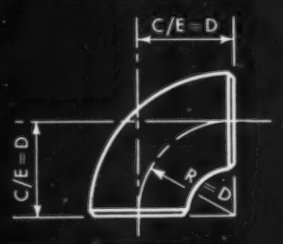


SIZES: 2" TO 20", INCLUSIVE

Same radius as ASA Elbows but with long integral tangent on each end — an exclusive Midwest feature that saves time and pipe. No price increase over ASA Elbows.

3

SHORT RADIUS

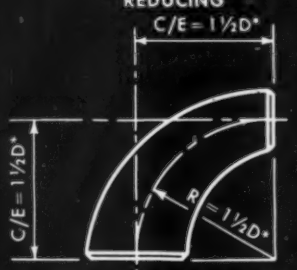


SIZES: 1" TO 30", INCLUSIVE

Where space limitations prevent use of ASA Elbows or Midwest "Long Tangent" Elbows shown above at right, these short turn elbows without tangents are recommended.

4

LONG RADIUS REDUCING



SIZES: 2" TO 12"*, INCLUSIVE

Midwest Reducing Elbow takes the place of a straight elbow and a reducer. It saves more than one-third of the welding and improves both design and appearance.

SYMBOLS { *C/E—Center-to-End Dimension* / *T—Length of Tangent* } *D—Nominal Pipe Size* *R—Radius* **D—Dimension is for larger Pipe Size*

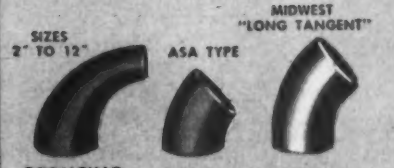
The *variety* of Midwest Welding Elbows is particularly important because of the exceptional latitude in design and economy in erection that it provides. For example, the Midwest Long Tangent Elbow permits faster, easier, more accurate lining up with pipe . . . removes weld from point of maximum bending stress . . . often eliminates a short nipple and its extra weld. Slip-on flanges are easily used with minimum change in flange and fitting.

This "Variety" is only one of several reasons why many users prefer Midwest Welding Elbows.

Only MIDWEST offers this VARIETY

MIDWEST WELDING FITTINGS Improve Piping Designs and Reduce Costs

90° ELBOWS

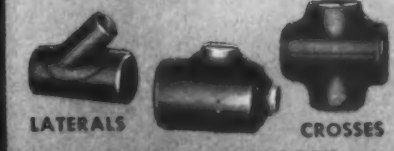


REDUCING 90° ELBOWS — 45° ELBOWS

LAP-JOINT STUB ENDS — REDUCERS

CAPS — SADDLES — SLEEVES

RETURN BENDS — TEES



LATERALS — CROSSES

REDUCING-ON-RUN TEES

SHAPED NIPPLES — FLANGES

MIDWEST PIPING & SUPPLY CO., Inc.

Main Offices: 1450 South Second Street, St. Louis (4), Mo.

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(Continued from page 122)

Harris-Seybold Co., was guest speaker and A. G. Hopcraft, director of purchasing, Cleveland Worm and Gear Co., acted as toastmaster. Taking for his subject "Profits—The Common Ground," the Cleveland industrialist pointed out how little people realize the importance of the profit system in providing taken-for-granted conveniences. Maintaining that American profits are fair, as well as desirable, the speaker stated that the corporate profits average only 3¼ to 4% of the sales dollar. A large part of these earnings are returned into new plants and tools. Mr. Mitchell noted that between the last two wars, England plowed back only 3% of her national income. At the same time America spent 15¼ to 20% of national income for betterment of facilities. As a result, America is producing almost half of the wealth produced in the world annually while Great Britain is in the midst of a struggle for industrial existence.

Exposition

More than 100 manufacturers of equipment, tools, and materials employed in maintenance activities had their products on display in the exhibition halls. Latest improvements in portable scaffolding, floor cleaning machines, roofing and floor-patching materials, and maintenance tools were in prominence. Both the show and conference were under the management of Clapp and Poliak, Inc., New York, although much credit for an excellent program should go to the advisory board and L. C. Morrow, editor, Factory Maintenance and Management, who was board chairman.

If you pipe it...there's a **Fairbanks valve** to control it

Here are two typical examples of the outstanding design, sound engineering and rugged construction that are built into every Fairbanks Valve. Years of experience in meeting all kinds of valve requirements for industry, have given Fairbanks Engineers a storehouse of knowledge in controlling the flow of water, steam, gas, oil, chemicals, etc. Consult them without obligation.

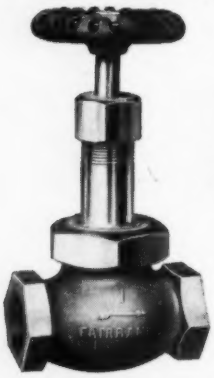

Fig. U-01
Renewable Composition Disc
Globe Valve — 150 lb. S.W.P.

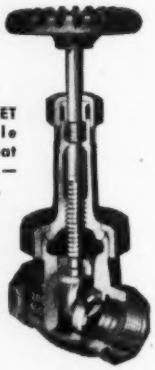

Fig. 0236
UNION BONNET
— Renewable
Nickel Alloy Seat
Gate Valve —
200 lb. S.W.P.

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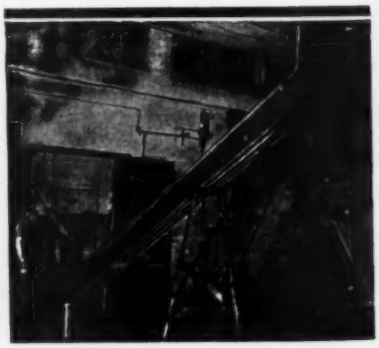

STOKER-VEYOR

The answer to your most pressing boiler room problem. Speeds filling of hoppers, and removal of ashes. Photo shows Stoker-Veyor in use at the Midland Hotel, Chicago. Operators report this installation results in substantial savings and a far cleaner boiler room. They say, "Now we can hold a man on the job". Ask for Bulletin 916.

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1115 W. ADAMS ST. • CHICAGO 7, ILLINOIS

4 Ways to Increase Boiler Room Efficiency..

Here are four precision washed industrial coals ready to step up your power output in a money-saving way...ready to deliver the utmost in efficiency at low cost.

OLD ABE...SKIBO...POWERHOUSE ...VOGUE...One of these great coals from the highly developed Western Kentucky field is RIGHT for your plant. All are economical, efficient fuels, tested and proved under most severe loads and conditions.

Modern preparation plants, large steady production and tremendous reserves assure an ample and permanent supply.

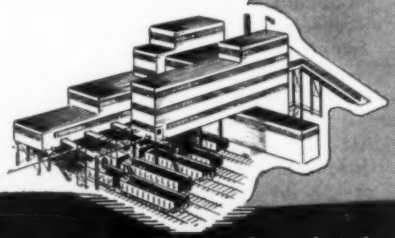
PRODUCED BY W. G. DUNCAN COAL CO.
Skibo COAL

POWERHOUSE COAL INDUS...

Vogue COAL

Take Advantage of Southern's Specialized Service

A member of Southern's staff of experienced fuel engineers is ready to come to your plant, chart results, and show you how any one of these premium industrial coals will solve your boiler room problems. Write, wire or telephone our nearest office for complete information.



Scientifically Prepared in Plants Completely Equipped with the Most Modern Facilities Known to the Industry

(19-ASPV)

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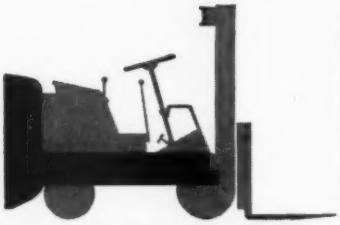
General Office: 333 North Michigan Avenue, Chicago 1, Ill.
Branches in: ATLANTA, BIRMINGHAM, CHARLOTTE, CHICAGO, KNOXVILLE, LOUISVILLE, MEMPHIS, NASHVILLE, ST. LOUIS
Sinclair Coal Company, Kansas City 6, Mo.—Western Representatives
Boon-Strachan Coal Company, Ltd., Montreal—Canadian Representatives

MEMBER BITUMINOUS COAL INSTITUTE

Rugged and Ready

—for the toughest mass handling jobs!



UNIT FRAME CONSTRUCTION

—another Towmotor efficiency feature

For counter-balancing the load, Towmotor puts as much weight as possible in the frame itself—where it adds strength and stability for maximum, trouble-free service.

See the New Towmotor Movie, "The One Man Gang," right in your office.

Towmotor's exclusive one-piece, all-steel frame construction provides an unusually sturdy unit—*extra* rigid for rugged service, *extra* easy to inspect and maintain. That's why Towmotors *stay* on the job dependably . . . even in 24-hour daily service. Compare Towmotor with any other fork lift truck and you will see why Towmotor's rugged features make every **M**ass **H**andling job easier, faster, safer. 10 models plus standard and specially designed accessories handle loads from 1,500 to 15,000 lbs.—a Towmotor for *every* job. Write for a copy of "Handling Materials Illustrated." Towmotor Corporation, Division 7, 1226 E. 152nd St., Cleveland 10, Ohio. Representatives in all Principal Cities in U. S. and Canada.

every handling job is easier with TOWMOTOR MH!

TOWMOTOR
THE ONE-MAN-GANG®

FORK LIFT TRUCKS and TRACTORS

RECEIVING • PROCESSING • STORAGE • DISTRIBUTION

BOOK REVIEWS

Power Plant Costs

Statistical data pertaining to steam-electric plant construction cost and annual production expenses are contained in a 406 page bound report compiled by the Federal Power Commission. A three page summary lists each plant by state and city and gives such information as: capacity, net generation, plant cost per kw, kind of fuel, production expense, and average Btu per net kwh.

In all, yearly data on 200 plants is furnished between the periods of 1938 and 1947. The data is in table form under the main headings of: Cost of Plant, Production Expenses, Fuel used, Turbine-generator Characteristics, and Boiler Characteristics.

"Steam Electric Plant Construction Cost and Annual Production Expenses". Published by the Federal Power Commission. Washington 25, D. C. Price $3.00 (when ordering refer to publication as F.P.C. S-72).

Rigging Handbook

First edition book under the authorship of W. E. Rossnagel is a practical treatise of all rigging applications. The book will be invaluable for the professional rigger, maintenance men, foremen and superintendents on construction, and executives interested in obtaining complete knowledge of rigging problems. This book is non-technical, and the numerous problems worked out contain only simple arithmetic.

Mr. Rossnagel emphasizes the need for safety in the rigging field throughout the book. Numerous illustrations show the correct and incorrect method of connecting fiber rope and wire rope so the operators can obtain the maximum of safety. The chapters on swing stages and scaffolds are of particular importance to anyone contemplating building changes and extensions.

Principal chapter headings are: Fundamentals; Hoisting Chains and Hooks; Slings; Wood for Structural Purposes; Painting and Repairing Steel Stacks; Ladders; Strength Calculations for Timers and Metal Beams; Cranes, Hoists, and Derricks; Accident Prevention; and Care for the Injured.

"Handbook of Rigging" by W. E. Rossnagel. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 18, N. Y. 322 pages. Illustrated. $4.75.

Human Relations Guide

As a service to the industry, The American Management Association is offering a sequel to its previously published supervisory handbooks. The new handbook guide entitled "The Supervisor's Management Guide" has been edited by M. Joseph Dooher and Vivienne Marquis and contains information collected from 17 operating executives and specialists in the management and industrial relation fields.

Case histories and discussions of successful supervisory programs and techniques developed by companies in all types of industry are presented. The book is intended as a desk manual for

executives and personnel concerned with industrial relation problems.

Information contained in the book covers the basic principles of sound human relations, supervisory attitudes and practices, executive responsibility, art of speaking effectively to employes, and tests to determine competent supervisors and executives.

"The Supervisor's Management Guide" edited by M. Joseph Dooher and Vivienne Marquis. Published by American Management Association, 330 West 42nd Street, New York 18, N. Y. 190 pages. AMA members $3.00. Non-members $3.50

Available Plastic Patents

Recently published booklet released by the U. S. Department of Commerce contains a report of available patents in in the plastic field. Each patent is reviewed, and a detailed description is given of each separate product, how it operates, how adaptable it is for public consumption, and any outstanding features.

Patents are listed under the following group headings: Automobile Accessories; Calenders and Clocks; Display Devices; Drafting; Electrical; Hangers; Illuminating Devices; Packages and Boxes; and numerous other items.

Manufacturers wishing to produce additional products will find this list of available patents valuable.

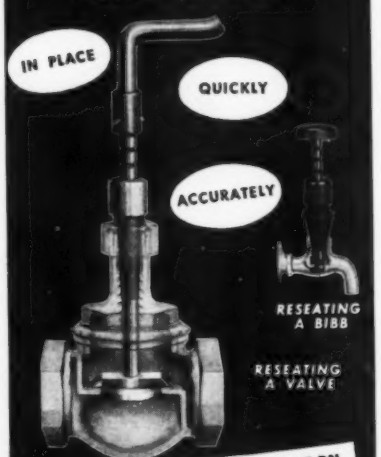
"Available Patents—Plastic Products and Processes" Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. or any Department of Commerce Field office. 70 pages. Price 25 cents.

RESEAT VALVES AND BIBBS

IN PLACE

QUICKLY

ACCURATELY



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PAYS FOR ITSELF ON FIRST 2 OR 3 JOBS!

Don't junk expensive globe or angle valves, bibbs, fixtures—reseat them! Order Skinner *Valve and Bibb Reseater*. Easy to use. Guaranteed cutters leave seat glass-smooth, level, tight.

1/4" to 2" $32.50
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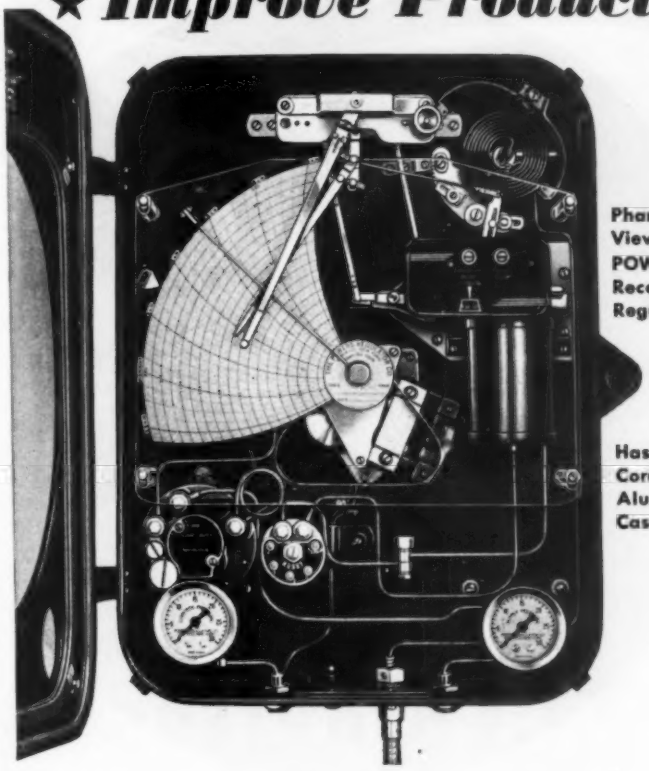
SOUTH BEND 21, INDIANA, U. S. A.

★ REDUCE COSTS
★ Improve Production



Phantom View of POWERS Recording Regulator

Has Non-Corrosive Aluminum Case

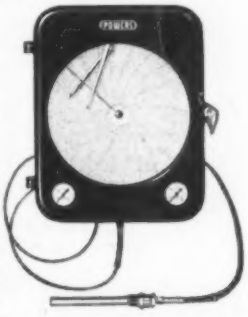
with precision control by—

POWERS

Air-Operated INDICATING AND RECORDING REGULATORS

For TEMPERATURE • HUMIDITY • PRESSURE

End losses caused by OVER-heating of processes or operations requiring precise control. Install POWERS pneumatic regulators. Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating.



Variety of Models: Recording Thermometers; Recording Regulators; Indicating Regulators; Wet and Dry Bulb Recording Regulators; Time Cycle Recording Regulators; Master and Sub-Master Indicating and Recording Regulators, etc. *Write for Bulletin 370.*

For Better Temperature and Humidity Control and valuable aid in selecting the right instruments for your requirements—phone or write our nearest office. There's no obligation. The Powers Regulator Co., 2777 Greenview Ave., Chicago 14, Ill. • 231 E. 46th St., New York 18, N. Y. • 1808 W. Eighth St., Los Angeles 5, Calif.

(102)

THE POWERS REGULATOR CO. • OFFICES IN 50 CITIES

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WITH POSITIVE MECHANICAL INTERLOCK

NEW EXCLUSIVE PRINCIPLE

EKSTROM CARLSON CONTROL PANEL 14" x 22" ILLUSTRATED

in ARROW AH HART STARTERS

The exclusive A-H mechanical interlock design, employed in all A-H 2-speed and reversing starters, positively prevents the closing of both sets of contacts at one time. Reverse contacts do not start to close until forward contacts are completely open. Switches are individually installed on a sturdy sub plate and are coupled by a dependable roller type, free floating deflective linkage to eliminate binding and sluggish action. Free release transfer action.

A-H MAGNETIC CONTROLS FOR BETTER APPLICATIONS FEATURE:

Small size; revolutionary design with new balanced mechanism; big, tough contacts — simple to replace; new alkyd hood and base; plus easy installation and maintenance. "RA" type magnetic starters are available in sizes 0, 1, 2 and 3 in local and remote control or selector switch types. All are ruggedly built for long service under tough operating conditions. Whether you specify, buy or use magnetic control units, Arrow-Hart merits your careful consideration.

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NEWS...

of men and companies

American Wheelabrator & Equipment Corp.—Robert T. Pring has been appointed technical director of the dust and fume division of the company. Following two years as an engineer with the Employers Group, Boston, Mr. Pring entered the employ of the Utah Copper Co. When this company became a division of Kennecott Copper Corp., Mr. Pring remained with the company and became director of the industrial hygiene department. He has resigned this latter position in order to assume his new duties as technical director of the dust and fume division of American Wheelabrator.

Riley Stoker Corporation—Announcement has been made of the appointment of E. J. O'Connell as sales engineer with headquarters at the Chicago office. Mr. O'Connell is a graduate of the University of New Hampshire and has had many years of power plant engineering experience.

Nordberg Manufacturing Co.—Jos. G. Broz has been appointed sales manager of the Four Cycle Diesel Engine Dept. according to an announcement by R. W. Bayerlein, vice president of the heavy machinery division. Mr. Broz was vice president in charge of sales of Busch-Sulzer Diesel Engine Co. of St. Louis, Mo. at the time that company was purchased by Nordberg. H. M. Cahill will assist Mr. Broz in directing the sales activities of the department.

J. G. Broz

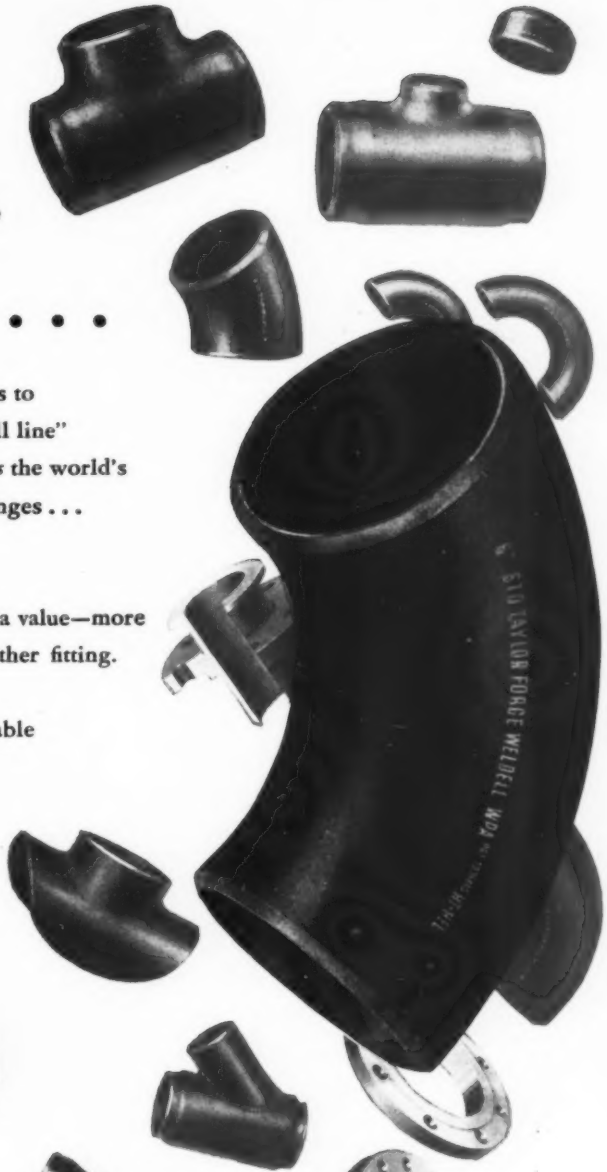
G. Winters

Towmotor Corporation—Gordon Winters, formerly in sales supervision work in Cleveland, is in charge of a new factory sales and service branch office opened in Oakland, Calif. Conveniently located in a modern building at 4th and Castro Streets, the new factory branch will be equipped with the most up-to-date tools and machinery to take prompt care of all types fork lift truck maintenance requirements.

Pennsylvania Crusher Co.—James E. Stine, chief engineer marked his thirty-first year with the company November 1949. Mr. Stine started as a draftsman in 1918 and was assistant chief engineer for twelve years, until his appointment as chief engineer in 1940. Also Edwin H. Keiper has been made chief service engineer of the company, his appointment dating from June 1949. Mr. Keiper, who has a thirty year service record started in 1919 as a draftsman in the engineering department. The

(Continued on page 130)

FULL LINE . .
FULL VALUE . . .
FULL SERVICE . . . .



We have repeatedly urged users of welding fittings to accept no less than the *full line.* When we say "full line" we don't just mean its *completeness* . . . though it *is* the world's most complete line of forged steel fittings and flanges . . . and it *does* contain the widest range of types, sizes, weights and materials.

When we say "full line" we mean full value—extra value—more and better features than can be found in any other fitting. The technical brains and forging skills which conceived these extra values continue to be available to you through the Taylor Forge organization, and through the Taylor Forge distributor who is your industrial neighbor.

Since Taylor Forge welding fittings "have everything," why compromise on less than the best?

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TAYLOR FORGE & PIPE WORKS General Offices & Works: Chicago 90, Ill. (P.O. Box 485) Eastern Plant: Carnegie, Pa. Western Plant: Fontana, Calif. • District Offices—New York: 50 Church Street • Philadelphia: Broad Street Station Bldg. • Pittsburgh: First National Bank Bldg. • Chicago District Sales: 208 S. LaSalle Street • Houston: City National Bank Bldg. • Los Angeles: Subway Terminal Bldg.

Do your piping systems create any fitting or flange problems for you?.....

If the information you need goes beyond the simple return of the coupon at the right, please write us fully. You will receive a prompt and detailed reply.

Please send a copy of your new catalog 484 covering welding fittings and forged steel flanges.

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Position .....

Company .....

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City..... Zone..... State.....

502-0250 Mail to Taylor Forge & Pipe Works, P.O. Box 485, Chicago 90, Ill.

BELMONT 19 . . . for hot and cold water rods and plungers; low and intermediate steam rods.
BELMONT 30 . . . for high pressure steam rods, expansion joints, air, and gas.
BELMONT 6102 . . . for rod and valve stems handling volatile distillates.
cut equipment "down-time" with . . .
BELMONT PACKINGS

BETTER SEALING...LONGER LIFE

Idle equipment affects production schedules . . . influences product quality and many times cuts deeply into profits.

To keep equipment producing, use Belmont, the Packings that have individual characteristics and are scientifically designed and constructed by packing specialists to *seal better* and *last longer*.

Easy to get . . . Belmont Packings are stocked by local distributors in every large industrial center. Or, if you have a problem that requires special engineering attention, write direct.

Catalog #40 is available, write for it.

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RINGS • SPIRALS • COILS • REELS
SPOOLS • SHEETS • GASKETS

FOR STEAM • WATER • OIL • GAS • AIR • ACIDS • ALKALIES • AMMONIA

(Continued from page 128)

Wharton L. Peters Machinery Co. has been appointed as a sales representative in St. Louis; The Swaney Company of Newtonville, Mass. has been appointed a sales representative in the greater Boston area; Stanley B. Tryer, Crosby, Minn. has been appointed sales representative, his territory to include all of Minnesota, the northern half of Wisconsin, and Michigan's upper peninsula; and Leatherman and Mertz has been appointed a sales representative to include Detroit and the northern and eastern counties of Michigan's lower peninsula.

Owens-Illinois Glass Co.—David Innes, former manager of the company's Kaylo division plant in Sayreville, N. J., has been named product development engineer according to T. A. Collins, general manager of the division. Also announced is the promotion of Curtis W. Howard to the position of general factories manager of the Kaylo Division.

D. Innes

C. W. Howard

Mr. Howard will continue to make his headquarters in Toledo. Mr. Innes will carry on his new work in connection with the sales department in Toledo and is being replaced in Sayreville by O. W. Pfeiffer. Mr. Innes will report to E. C. Shuman, director of research, and will be associated with W. M. Hankins, general sales manager of the division. During the past several months, Mr. Howard has been administrative assistant to Mr. Collins, devoting his time particularly to manufacturing operations.

The Cooper-Bessemer Corp.—Operators of the company's equipment in Wyoming, Montana, and central Canada are now being greatly benefited by a new local Diesel service as a result of established field maintenance facilities in Great Falls, Montana. In charge is C. R. Jones who is assisted by A. A. Rothenbuhler with facilities located at 506 Fifth Avenue South.

National Electric Products Corp.—Earl M. McCabe is a new sales representative throughout Ohio and will make his headquarters at 1836 Euclid Ave., Cleveland, according to an announcement by H. E. Colliver, Ohio territory sales manager. After completing courses at Texas Tech College, Lubbock, Texas, Mr. McCabe joined the Cleveland Electric Illuminating Co. He served the public utility in various capacities.

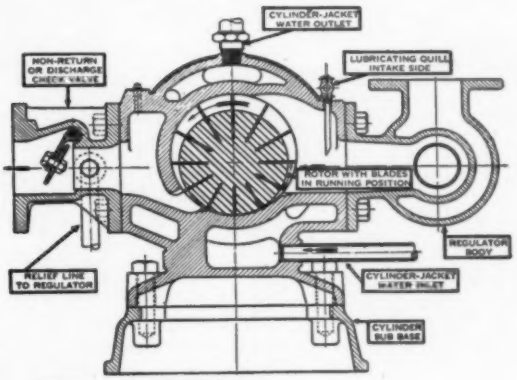
James C. Shearer has joined the sales staff and will cover the southern counties of Ohio. He will make his headquarters in the Enquirer Building, 617 Vine St., Cincinnati.

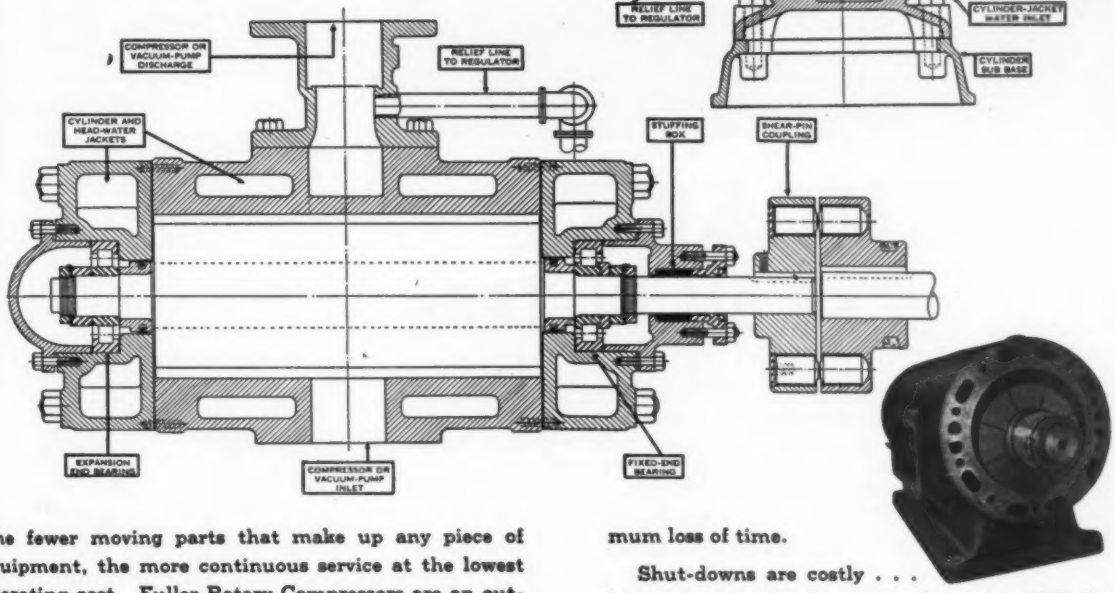
U. S. Hoffman Machinery Corp.—Announcement has been made of the appointment of B. Russell McBath as vice president in charge of manufactur-

(Continued on page 132)

Rugged Construction . . .
Simplicity of Design . . .
Minimum of Moving Parts
Rotor - Bearings - Blades

FULLER ROTARY COMPRESSORS





The fewer moving parts that make up any piece of equipment, the more continuous service at the lowest operating cost. Fuller Rotary Compressors are an outstanding example of simplicity of design . . . few moving parts: rotor—bearings—blades.

Ruggedly constructed, they will withstand long, continuous service and, after severe, gruelling operating periods, if inspection and check-up is desired, the machine design permits doing this easily and with a minimum loss of time.

Shut-downs are costly . . . lost time can never be recovered . . . install Fullers for day in, and day out, continuous service.

Fuller Rotaries are built for capacities to 3300 c.f.m., actual free-air delivery, 125-lb. pressure. For vacuums to 29.90-in. (referred to 30-in. barometer).

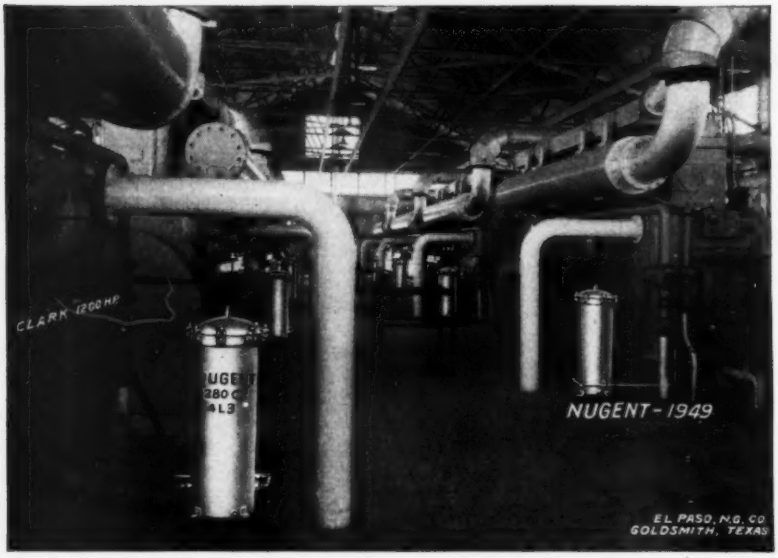
Write for Bulletin C-5. It's yours for the asking.

FULLER COMPANY
CATASAUQUA—PENNSYLVANIA
Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 420 Chancery Bldg.

FULLER — A LIFETIME OF NEW MACHINE EFFICIENCY

C-185

Clean oil means longer compressor life



with NUGENT ABSORBENT OIL FILTERS

Nugent Absorbent Oil Filters get out more of the harmful impurities that get into oil — 99.8% by actual test and cleaner oil means that engines, compressors and all machinery will last longer and require less maintenance, while at the same time require less frequent replacement of oil.

Fig. 1280CF, the Nugent Filter type shown above installed on engine-compressor units at the Goldsmith, Texas, station of the El Paso Natural Gas Company, is typical of Nugent depth type pressure liquid filters. The filtering material generally used is a superior quality of cotton waste, wool, excelsior, asbestos or cellulose. No chemicals, bleaches or filtering earths are used. All units have very large capacity for their size. Fig. 1280CF is available in a wide range of capacities. Write for complete information.

Other Nugent filters are available to meet virtually every need.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.

404 N. Hermitage Ave. CHICAGO 22, ILLINOIS

Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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(Continued from page 130)

ing. He will make his headquarters at the Lamson Street plant of the company at Syracuse, N. Y. Mr. McBath comes to the company from the Worthington Pump and Machinery Corporation, which he served in various capacities for 22 years.

Aetna Ball and Roller Bearing Co.—W. A. Wood, president has announced the appointment of J. J. Rozner as works manager. Mr. Rozner joined the company's engineering department as a draftsman 21 years ago and has been chief engineer for the past 10 years—a post he will continue to hold together with the supervision, as works manager, of all manufacturing operations.

Graver Water Conditioning Co.—Three of the parent company's engineering representatives have been appointed as sales agents. J. R. Fortune & Son, Detroit, Mich.; The Stapp Engineering Co., Denver, Colo.; and Process Equipment Co., Tulsa, Okla. Appointment of Brookman-Kron Associates as sales engineering representative in the Buffalo, N. Y. territory, with headquarters at 259 Delaware Avenue, Buffalo 2, N. Y. has also been announced. This company is headed by Roger R. Brookman and E. Philip Kron. Announcement has been made of the appointment of Fred S. Renauld & Co. as Los Angeles representative, with headquarters at 1014 W. 84th Place, Los Angeles, and operating in southern California, Mexico, and lower California.

Greene Tweed & Co.—John R. Boyer has been appointed sales representative for the Chicago and South Bend areas and Wisconsin by Greene, Tweed & Co., North Wales, Pa. Mr. Boyer, a veteran and a graduate of the Wharton School, University of Pennsylvania, will locate in Chicago. His appointment was effective December 1.

J. R. Boyer

A. J. DeFino

Fedders-Quigan Corporation — Announcement of the appointment of Anthony J. DeFino as general manager of the Buffalo division has been made by the company. Mr. DeFino has held key positions in various phases of the company's sales and manufacturing activities centering around heat transfer equipment. In taking over his new assignment, Mr. DeFino combines an extensive knowledge of high production methods and contract sales procedures. Mr. DeFino will direct operations of the Buffalo Division from his offices in the main plant at 57 Tonawanda Street.

Fairbanks, Morse & Co.—Appointment of R. L. Van Alstyne as manager of all scale factories has been announced by the company. His duties

(Continued on page 134)

Here's the RIGHT FORMULA *for choosing steam traps*

BE SURE you use the right formula in figuring its cost when you choose a steam trap. Purchase price alone . . . never gives a true cost picture. Figure the installed cost (adding installation and maintenance costs) and you've an honest picture of steam trap costs.

Estimating costs in this manner, Super-Silvertop Steam Traps always assure lower ultimate cost. The conventional trap requires costly fitting and labor to get it installed, while Super-Silvertops fit snugly as a pipe union or elbow . . . saving up to nine fittings plus sixty minutes of installation time. In addition, Super-Silvertops save forty-five minutes whenever you replace a part or clean. Use the right formula in figuring trap costs, and you'll choose Super-Silvertops every time. Write for free copy of "Solving Steam Trap Problems" which gives further information on cutting steam trap costs.

THE V. D. ANDERSON COMPANY
1950 WEST 96TH STREET • CLEVELAND 2, OHIO

MAIL COUPON NOW!

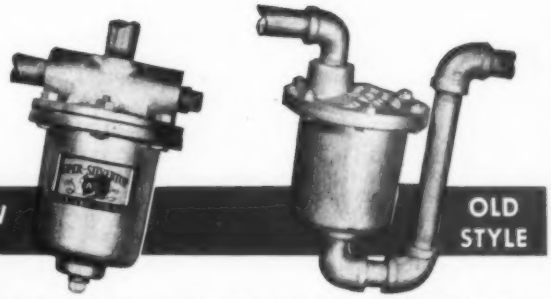
WRONG FORMULA

X = PURCHASE PRICE OF TRAP

$\overline{X}$ = ONLY EXPENSE OF TRAP

RIGHT FORMULA

X = PURCHASE PRICE OF TRAP
Y = COST OF INSTALLING TRAP
Z = COST OF MAINTAINING TRAP
$\overline{X+Y}+Z$ = TOTAL EXPENSE



USE SUPER-SILVERTOP IN-LINE OR AS AN ELBOW

Save Money With SUPER-SILVERTOPS

THE V. D. ANDERSON COMPANY
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Send me a copy of the booklet, "Solving Steam Trap Problems."

Name .....

Address .....

City ..... *State* .....

In Canada: Bawden Machine Co., Toronto

TWO WEAPONS in your battle against RISING COSTS

In your constant struggle against mounting production and maintenance costs, you need the RIGHT tools. Neglected or improperly cleaned and expanded condenser and heat exchanger tubes syphon a sizable slice of yearly profits. With AIRETOOL cleaners and expanders always on hand you can count on your condenser and heat exchangers working FOR you—not AGAINST you. For descriptive literature, write The AIRETOOL Mfg. Co., 318 S. Center St., Springfield, Ohio.

NEW TUBE ROLLING CONTROL

This precision system does away with risk of over and under expanding condenser and heat exchanger tubes. Just set a dial calibrated for the correct expansion of each tube size and metal type, insert an AIRETOOL G-800 or G-1200 ball bearing type expander and when the tube is properly rolled the control automatically shuts off. For the first time you are assured uniformly tight tube joints, reduced tube end corrosion, fewer tube failures, longer expander life and fast simple operation.

POWERFUL EFFECTIVE CONDENSER TUBE CLEANER

AIRETOOL'S geared cleaner No. CC-375 removes severest scale deposits . . . even from completely plugged small tubes. It features a powerful motor which operates up to 1200 RPM . . . built-in flushing system . . . convenient handle control valve and a muffler that does not reduce power. Designed for condenser tubes ⅜" to 1¾" I. D.

A variety of drill heads available for every scale condition.

There's an Airetool cleaner and expander for every type of tubular construction

AIRETOOL

MANUFACTURING COMPANY

SPRINGFIELD, OHIO

BRANCH OFFICES:

New York, Chicago, Philadelphia, Houston, Baton Rouge, Tulsa.

Sales Representatives in Principal Cities

(Continued from page 132)

include the administration of the new scale development and research department as well as the supervision of both the St. Johnsbury, Vermont, and East Moline, Illinois, scale factories. He will continue to maintain his office in East Moline.

Layne & Bowler, Inc.—A. W. McLean, manager of Layne Western Company at Chicago died November 24, in Copley Memorial Hospital at Aurora, Illinois. He was 68 years old. In the early 1900's Mr. McLean went into the well water supply and pump business and after 45 years in the field he was an accepted authority on water well construction in northern Illinois.

E. F. Drew & Co., Inc.—Appointment of J. S. Beecher as a member of the technical department of the power chemicals division has been announced by the company. Mr. Beecher, a graduate of the University of Pittsburgh, has had many years of experience in the power chemical and related fields. His new assignment to the technical staff involves survey and research work in the New York laboratories of the company.

Northern Equipment Co.—Don Allshouse, advertising manager for the company since 1928, has also been named advertising manager for Vulcan Soot Blower Corp., Dubois, Pa. A consolidated advertising department for these two divisions of Continental Foundry & Machine Co. will be maintained at 1945 Grove Drive, Erie, Pa.

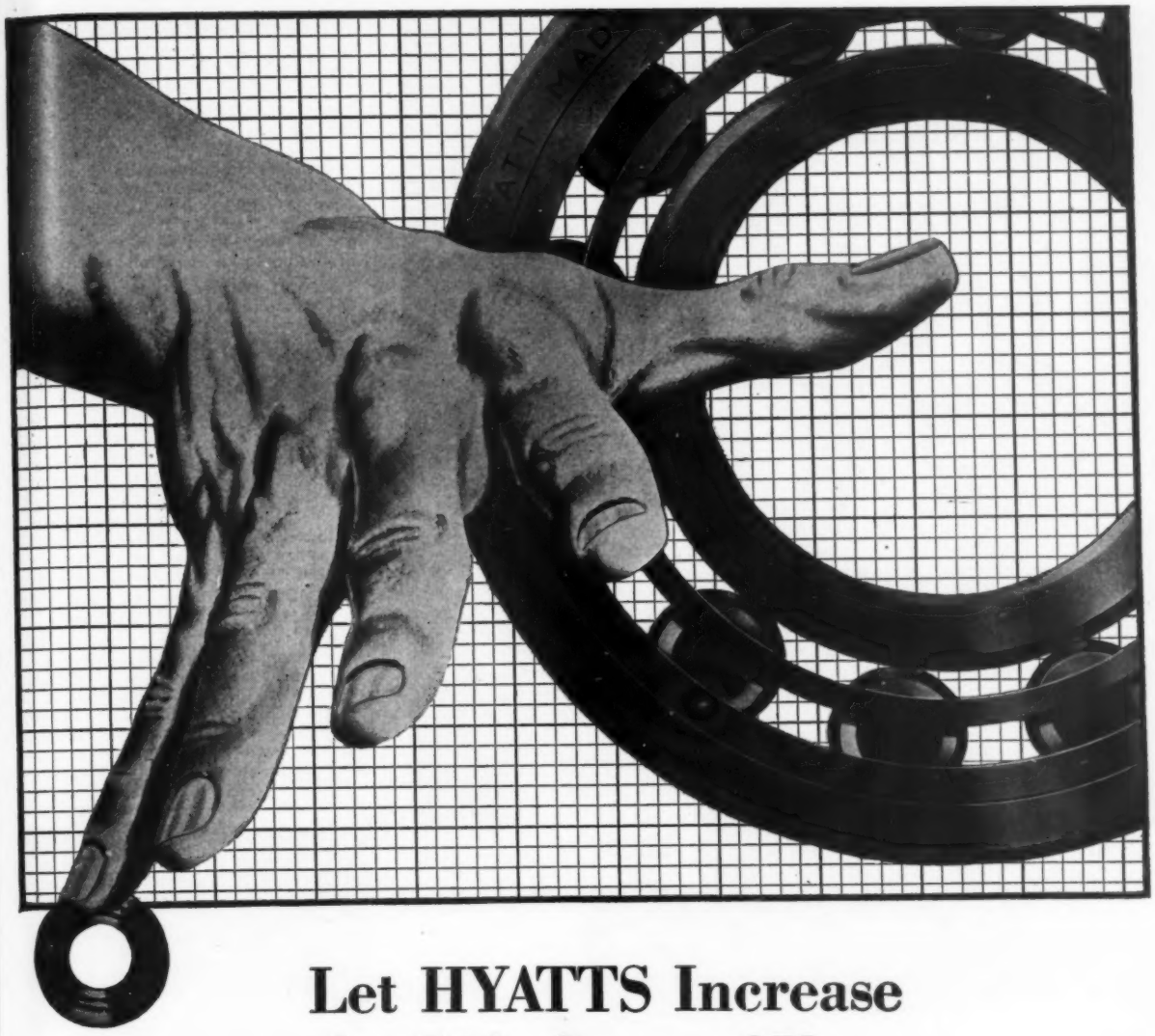
D. Allshouse

R. L. McFadin

The Marley Company, Inc.—Robert L. McFadin has been named manager of the merchandising sales department and as a result, has transferred to the main offices of the company in Kansas City, Kansas. For the past year he has been in charge of merchandising sales in the New York office, and in his new position will have charge of such sales for the entire organization. He has been with the company since March 1948.

Dearborn Chemical Company—C. C. Rausch, assistant vice president, has been appointed manager of the industrial department and will head rust preventive sales in all company markets. J. G. Surchek, technical advisor and engineer, has been made assistant manager of all production and maintenance sales. E. M. Welch has joined the Chicago office as manager of sales of water treatment and equipment. C. S. Silsbee has been named as assistant manager in charge of all national accounts and service. A. H. Reynolds, formerly directing chemist has been appointed director, product development, and will

(Continued on page 136)



Let HYATTS Increase the Life Span of Your Machinery and Equipment

If you build, sell or buy machinery or mechanical equipment, you know that wheels, gears and shafts must operate smoothly, accurately, quietly to be efficient.

Load capacity—speed—size—space are reckoned with by experienced engineers in every field who for more than fifty years have applied Hyatt Roller Bearings to machinery and equipment of every description.

With Hyatts applied in the vital positions, longer life is built in—non-stop production is assured—power costs are cut and everyone—builder, seller and buyer—is satisfied with their bearing equipment.

Perhaps we can help you. Just write to Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

(Continued from page 134)

be assisted by L. O. Gunderson as assistant director. Dr. Wayne L. Denman has been promoted to the position as directing chemist with headquarters at the company's main factory and laboratories at 1029 W. 35th St., Chicago. Milton H. Hagman has taken over all responsibilities of controller, replacing Adolph Geidel who retired as assistant treasurer after 40 years service with the company. Fred W. Mayer has been promoted to the position of auditor.

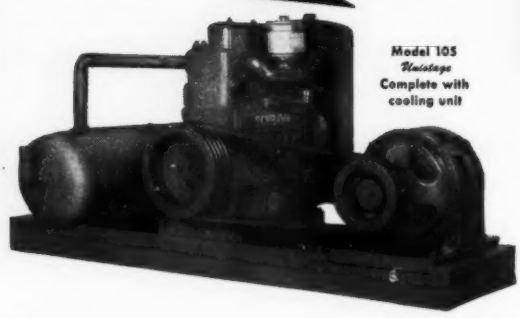
Stewart-Warner Corporation—David C. Peterson has been named director of engineering and manufacturing of Division One according to an announcement by F. A. Hiter, senior vice president of the company. Director of engineering of Stewart-Warner since 1946, Mr. Peterson is assuming, as director of both engineering and manufacturing, duties relinquished by George Thomas, plant manager since 1943. Mr. Thomas has been appointed production consultant to the senior vice president.

Illinois Engineering Co.—Announcement has been made of the appointment of Thomas Engineering Company, 1325 East 35th Street, Tulsa, Oklahoma as the company's representatives for the State of Oklahoma.

Jerguson Gage & Valve Co.—James A. Ford, sales manager has been elected vice president and director at a recent meeting of the board of directors. Mr. Ford came to the company as sales manager in 1945 after long experience in the field of instrumentation and controls.

1950

MORE AIR economically!



Model 105
Horizontal
Complete with
cooling unit

● FOR PRODUCTION and MAINTENANCE

● FOR SPEEDY PNEUMATIC TOOLS

SCHRAMM INC. offers a complete line of Industrial Compressors in sizes ranging from . . . ½ to 100.

Built and designed for continuous heavy duty service with a minimum of attention.

Available in "V" or Flat Belt Drive . . . on base for belt drive from motor or engine . . . or, with direct motor drive. No special foundation required . . . can be bolted to any substantial floor.

Where running water is not available the SCHRAMM Cooling Unit will prove adequate under severest conditions. Accessories essential to any modern industrial installation can also be provided.

Write for Bulletin #4910.

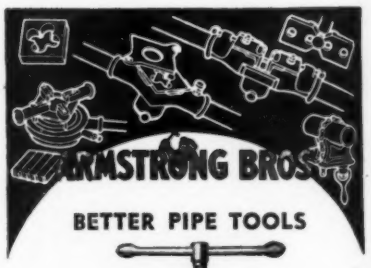
Important Features

Compact...Easy To Install
Mechanical Intake Valve
Force Feed Lubrication
100% Water Cooled
Electric Push Button Starting
En Bloc Construction
Easy Accessibility
Vibrationless
More Bearing Surface

SCHRAMM INC.

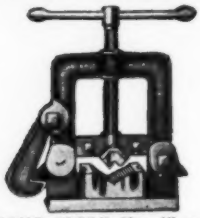
THE COMPRESSOR PEOPLE

WEST CHESTER PENNSYLVANIA



ARMSTRONG BROS.

BETTER PIPE TOOLS



"ARMSTRONG BROS." Pipe Vises are built for life-time service with *unbreakable* drop forged steel hooks. Other design improvements include: oval handle ends (will not pinch hands), replaceable tool steel jaws with milled teeth, and on sizes 70 and 71, a solid 1-piece jaw that prevents kinking of small pipe. There are always extra quality features in an "ARMSTRONG BROS." Pipe Tool.

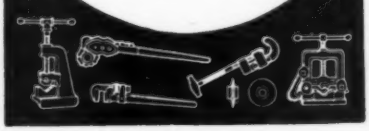
Write for Catalog.

ARMSTRONG BROS. TOOL CO.

5237 West Armstrong Ave., Chicago 30, Ill.

Eastern Whse. and Sales:
199 Lafayette St., New York 12, N. Y.

Pacific Whse. and Sales Office:
1275 Mission St.
San Francisco 3, Calif.



Dodge Manufacturing Corp.—Appointment of Ralph Hanes as director of advertising and sales promotion has been announced by Harry A. Torson, vice president in charge of sales. Since 1942 Mr. Hanes has been sales promotion manager of the mechanical goods division, United States Rubber Co., New York, where he was responsible for the advertising and sales promotion program of eleven sales departments and three sales subsidiaries. Mr. Hanes succeeds the late W. W. French who had held this position for more than 20 years.

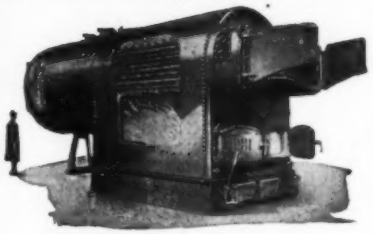
R. Hanes

K. W. Horsman

Worthington Pump and Machinery Corp.—Appointment of K. W. Horsman as works manager Dunellen, New Jersey Works to succeed B. R. McBath who has resigned, has been announced by the company. Mr. Horsman joined Worthington in 1929 as a field engineer, and later became superintendent of the steel construction shop.

After being with the company for over 24 years, Karl MacDonald, former chief engineer and later consultant, has retired from active service.

KEWANEE®
HEAVY-DUTY



10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 96-D2
for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

BELTING
BUILT FOR THE TOUGH JOBS!

HEWITT-ROBINS Conveyor Belting gives longer service at less cost

When trouble comes by the ton . . . whether it's heavy abrasives like ore and rock or wet, gritty materials like fines and slag . . . the easiest, most dependable and most economical way to move it is on a Hewitt-Robins conveyor belt.

For over half a century the Hewitt Rubber Division of Hewitt-Robins Inc., has pioneered in making the right belt for every conveyor installation. Today, engineers the world over instinctively specify Maltese Cross® where the going is really tough, Ajax® for general service, and Conservo® for lighter applications and portable conveyors.

In Hewitt Rubber belting they get full protection against moisture, oils, flexing and ply-separation, as well as treatment against mildew. They get abrasion-resistance from extra-tough rubber covers, heavily textile-reinforced for maximum strength plus flexibility.

* * *

Engineers turn to Hewitt-Robins not only for belting but for entire belt conveyor systems. They know Hewitt-Robins is *the only firm able to accept complete responsibility*. For belting, address Hewitt Rubber Division, Buffalo 5, N. Y.; for machinery, Robins Conveyors Division, Passaic, N. J.; for engineering services, Robins Engineers Division, 157 Chambers St., New York.

HEWITT-ROBINS
CONVEYOR BELTING

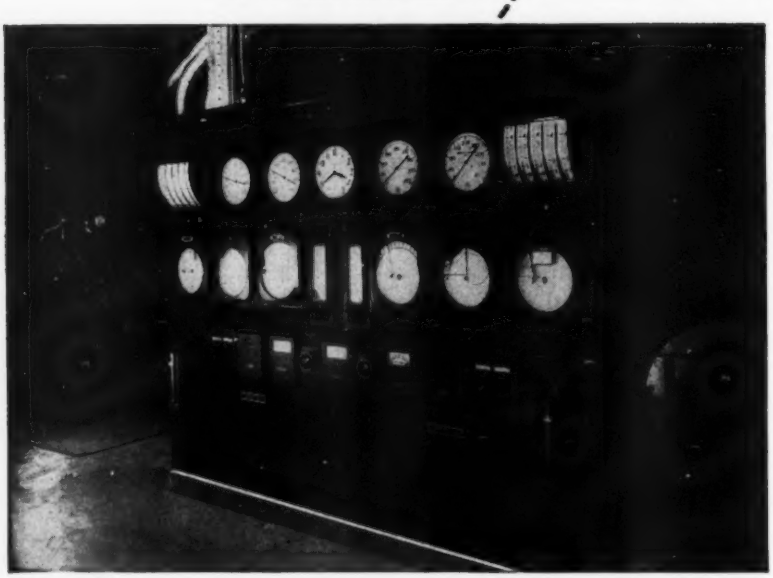
HEWITT-ROBINS HR INCORPORATED

BELT CONVEYORS *(belting and machinery)* • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

IT HAS MODERN-NESS THAT

STAYS MODERN

"IT'S ELECTRICAL"



There's one sure sign of a truly modern steam plant that will *stay modern* for many years to come:
HAYS AUTOMATIC COMBUSTION CONTROL.

No danger here of obsolescence after a few years! . . for Hays control is electrical. It will still be functioning smoothly, automatically — still maintaining combustion efficiency, still saving fuel — after many years of unfailing accuracy.

Look into this modern money-saving system — just as a matter of "good business." Ask Hays users why they prefer it to any other. Inspect Hays installations — notice the orderly neatness of panel interior; observe the absence of involved linkages, piping systems and accessories; see how easy it is to change from automatic to manual control or vice versa by simple operation of a switch.

You'll find Hays' 40-page book No. 47-605 exceedingly worth reading. Better ask for it — no obligation.

THE HAYS CORPORATION • MICHIGAN CITY 2, INDIANA

HAYS Automatic COMBUSTION CONTROL

INDUSTRIAL INSTRUMENTS — INDUSTRIAL CONTROL — FLOWMETERS — GAS ANALYZERS — DRAFT GAGES — CO RECORDERS

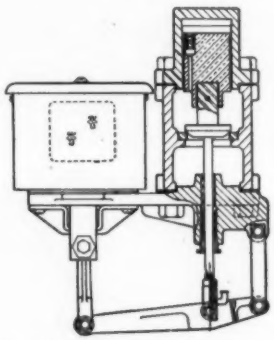
NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 14)

pivot post knob turned clockwise to complete the operation. For cutting irregular shapes, the straight-edge blade is replaced with a curved blade set so the tip emerges just below a guide line on the side of the cutter. The tool is then pulled toward the operator, keeping the guide line on the line to be cut. The cutter can also be used as a knife to cut irregular shapes by setting the curved blade about ½ in. below the body of the tool. To cut straight strips, the white washer between pivot post knob and body is placed between the slide block and body, making the block protrude as a guide to slide along the edge of the material. Zimmerman Packing Co.

320—NEW SOLENOID VALVE ENDS WATER HAMMER

To eliminate the water hammer that can result from the sudden closing of a valve in a high velocity pipe line, the Johnson Corporation has developed a special dash pot design now available in its line of direct operated solenoid valves. The new valve is de-



signed for normally closed operation and slows down the closing action of the valve 1½ to 2 seconds. Dash pot construction consists of a bronze piston fitted within the top housing of the valve, and pinned to the valve to follow its movement. An upward seating ball check controls the flow through a port in this piston. When valve is opened, and piston moves up, liquid above piston flows freely through the port so there is no resistance to the instant opening of valve oriface. When valve closes, however, the ball check closes the port; liquid must then flow between the piston and the housing, a restricted passage which slows the closing of the valve. Piston and valve are independent of the action

(Continued on page 140)

One for every place . . .

and one place to get them all

PILLOW BLOCKS ENGINEERED BY SKF

Specify pillow blocks and flanged mountings by SKF and you get bearings and housings engineered as a unit. What does this mean to you? It means you get the full benefit of SKF's skill and precision methods of manufacture. It means you're sure of minimum friction and trouble-free, low-cost operation. It means efficient seals that retain lubricant . . . keep out dust and abrasive elements. It means minimum maintenance . . . maximum efficiency.

SKF supplies 5 basic types of pillow blocks for shafts from ½-inch to over 9-inches . . . and 2 basic types of flanged mountings for shafts from ½-inch to 2 7/16-inches. Whether you need Series SES for lightly loaded applications or Series SDAF to withstand unusual shock and heavy thrust loads . . . or any intermediate type . . . there's an SKF pillow block that's exactly right for the job.

Check your SKF Distributor, he has a stock of these pillow blocks and flanged mountings to meet *all* your requirements. *SKF Industries, Inc., Philadelphia 32, Pa.* 7044

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

INTEGRITY · CRAFTSMANSHIP · METALLURGY · TOLERANCE CONTROL · SURFACE FINISH · PRODUCT UNIFORMITY · ENGINEERING SERVICE · FIELD SERVICE

SKF PILLOW BLOCKS

Pioneers of the Deep Groove Ball Bearing—
Spherical Roller Bearing—Self-Aligning Ball Bearing

NEW!

C-O-TWO

DRY CHEMICAL TYPE FIRE EXTINGUISHER

EXCLUSIVE DESIGN

assures you of fast, positive fire protection

SELF-CONTAINED UNIT . . . rugged construction . . . no extra gadgets protruding or complicated operating parts . . . one of the most efficient, foolproof, easy-to-use fire extinguishers known . . . two convenient sizes, 20 pound capacity and 30 pound capacity.

C-O-TWO DRY CHEMICAL STAYS FREE FLOWING . . . no syphon tubes or valves within the cylinder to become clogged or inoperative . . . discharge hose and squeeze type discharge nozzle remain empty until the fire extinguisher is actuated. Inverting the fire extinguisher before using provides mechanical breakage by changing the position of the dry chemical in the cylinder. Bumping to actuate the fire extinguisher provides additional mechanical breakage as well as continuous carbon dioxide gas pressured agitation or fluffing of the dry chemical. These combined features plus a skillfully blended free flowing extinguishing agent assure you of a faster, more effective and complete discharge.

APPROVED . . . Underwriters' Laboratories, Inc. rating is B-1, C-1. C-O-TWO Dry Chemical is non-conducting, non-corrosive, non-abrasive, non-freezing and non-toxic . . . highly effective on flammable liquid and electrical fires.

RECHARGEABLE ON-THE-SCENE . . . no special tools needed . . . one piece removable top assembly leaves large unobstructed opening in the top of cylinder for refilling. C-O-TWO Dry Chemical for recharging is available in handy pre-measured moisture proof containers.

Write today for complete free information on this new, quick-acting fire extinguisher . . . no obligation.

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

(Continued from page 138)

of the valve opening push rod. Available in ¾, 1, 1¼, 1½ and 2 inch sizes.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

321—RESURFACE FLOORS WITH PLASTIC TYPE MATERIAL

One minute after application of a new plastic type floor material a 50,000 lb load can be trucked over it. The material can be used either for patching wood or concrete floors, or for complete resurfacing of aisleways, loading platforms, ramps, and drive-

ways. No experienced labor is necessary to apply and it can be installed with either the tamper (which is supplied with the initial order of one drum) or by rolling. Since the material is set by compression, rather than by water evaporation, the more traffic that flows over it and the heavier the load, the smoother, harder, and better the floor becomes. It is packed in 55 gal lever-top drums, ready for use and no mixing is required. The Monroe Co., Inc.

322—UNDER FEED-OILER IS SHATTERPROOF

New under-feed oiler is intended to lubricate bearings and shafts that require a very small amount of oil. The oiler is mounted at the bottom of the bearing. One end of the solid felt wick is held in contact with the shaft by positive spring action, the other end rests at the bottom of the oil reservoir. Oil is raised by capillary action to the tip of the wick where it is distributed along the shaft. Oiler stops feeding when machine is not in

(Continued on page 142)

All These Were Once
DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations. RC-116

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

*Enterprise Wheel & Car Corporation, Bristol, Virginia

. . . they're a "SNAP" with ROSS lift trucks

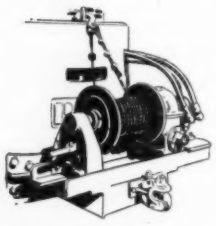
Big, bulky loads can cause increased handling costs. But at Enterprise Wheel & Car Corporation such costs have been greatly reduced by a ROSS Lift Truck. It handles raw materials in 5-ton loads . . . sub-assemblies and completed assemblies . . . loads out shipments. In addition, it efficiently augments the yard crane . . . Says Mr. F. A. Jones: "We find the ROSS exceptionally valuable in that we can now store shorter-length materials in our general storage yard. This releases space under the crane for the extremely long structurals and bars which the crane handles."

Investigate ROSS Lift Trucks (capacities 5,000 to 18,000 lbs.) for *your* plant . . . find out how they can become vital links in your materials-handling system . . . it will pay you.

ROSS CARRIERS . . . Speed transportation of long materials and unit-loads. Capacities, 10,000 to 30,000 lbs.

POWER-WINCH ATTACHMENT

Adds to versatility of ROSS Lift Trucks. Permits faster, easier spotting of railroad cars, moving of machinery, skidding of heavy loads. Fits all models.



Rely On ROSS

THE ROSS CARRIER COMPANY
283 Miller Street, Benton Harbor, Michigan, U.S.A.
Direct Factory Branches and Distributors Throughout the World

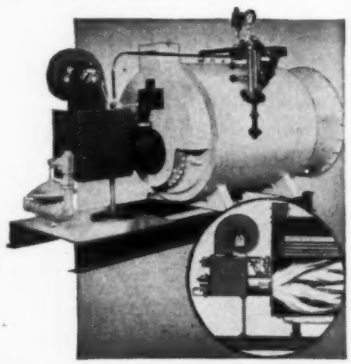
(Continued from page 140)

motion. Crystal-clear, shatterproof plastic bottle keeps oil supply always visible. Heavy steel base is cemented and roll-clinched to plastic reservoir, to eliminate possible leakage. Available in 1, 2, and 4 oz. capacities. Trico Fuse Mfg. Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

323—AUTOMATIC GAS-FIRED BOILER IS IMPROVED

Improvements which have been embodied in the automatic gas-fired packaged boiler are designed to make this unit a complete "steamboiler-plant" which has all the requirements of a good boiler together with the special advantages of gas-firing and the



Scotch or vertical tube design. The shell of the boiler is a horizontal steel cylinder, containing inside of it, another steel cylinder which is the furnace in which the gas is burned. At the back of the furnace is an insulated chamber from which small, long return tubes conduct the furnace gases back the entire length of the boiler, so that the maximum amount of heat may be extracted. Air for combustion is furnished by rubber mounted air blower, so no air-stack is needed. Gas at constant pressure is supplied by the gas pressure regulator in which both the air and gas can be instantly adjusted to completely burn the gas without CO. Ignition is by push button and in event of flame failure all gas is instantaneously shut off by an electronic flame safety unit. When desired steam pressure has been reached, main gas and air supply are cut off by automatic shutting off of gas valve and blower, leaving only small pilot flame to relight burner when steam pressure drops. All heating surfaces are below the water line so that "burning" of tubes is prevented. Heat transfer surfaces are designed so that turbulent

(Continued on page 144)

COPES

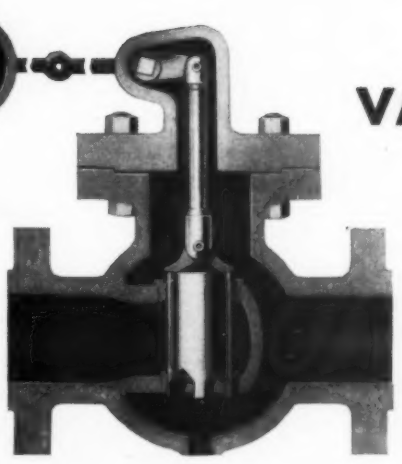
BALANCED VALVES

Wherever you use float valves, avoid losing any of your operating force in the stuffing box. Insist on low and constant valve stem friction.

Make sure of instant, accurate response to your actuating force—no matter what your flows and pressures—by demanding close control of the unbalanced forces found in every valve.

Provide for minimum pressure losses at high flows by requiring your valve ports to be accurately designed for the conditions you specify.

In other words—insist on COPES Balanced Valves. They offer all these important advantages —plus long service life with minimum maintenance. Write in detail about your needs.



With the COPES Type BI Valve, rotating stem means low stuffing box friction. Accurate balance assures quick and accurate response. Exact capacity you need is provided.

Float-operated COPES Type BI Valve controls flow of condensate from flash tank to storage tank.

Flow of blow-down water from a flash tank is controlled by this float-operated COPES Valve.

Water level in a deaerating heater is controlled by this float-operated COPES Balanced Valve.

NORTHERN EQUIPMENT COMPANY
204 GROVE DRIVE, ERIE, PA.

BRANCH PLANTS: Canada, England, France, Italy and Austria. *Representatives everywhere.*

Bulletin 443-B gives condensed data on all major COPES products. Write for a copy—your letterhead, please. Keep it for reference.

COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

A Silver Mine 12 ft. long and 7 ft. wide...

That Pays a 100% Dividend Annually

THIS silverware manufacturer struck it rich the day it installed this AAF Airmat Dust Arrester. The unit collects silver dust resulting from the polishing and buffing of sterling flatware. Value of the metal reclaimed the first year more than paid for the equipment and the dividends have been piling up ever since.

But you don't have to process precious metals to reap the benefits of Roto-Clone* Dust Control. Even if you collect dust only to throw it away, you still receive handsome dividends in the form of lower maintenance costs and improved working conditions.

Whether you operate a flour mill or a bakery, a foundry or a lead mine; manufacture shoes or automobiles—there are one or more operations where Roto-Clone equipment can turn dust into "pay dirt".

The Roto-Clone line offers a type and size unit to meet every dust control problem. Why not let an AAF representative analyze your dust-producing operations. He can show how Roto-Clone equipment will save you money and help you to better serve both your employees and community.

AMERICAN AIR FILTER COMPANY, INC.
349 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF
ROTO-CLONE
DUST CONTROL EQUIPMENT

*ROTO-CLONE is the trademark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.

(Continued from page 142)

flue gas flow results and maximum extraction of heat is achieved. The unit is built in nine different sizes, ranging from 12 hp to 100 hp. Eclipse Fuel Engineering Co.

324—SPEED CHANGES MADE AUTOMATIC WITH CONTROL

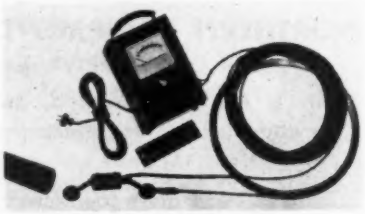
New hydraulic control has been developed by Reeves Pulley Company for use on the vari-speed motodrive to provide an accurate means of obtaining automatic speed changing. With this control it is possible auto-

matically to control tension, velocity, pressure, temperature, liquid level of materials in process, and to synchronize the operating speeds of machines in the production line or of parts of the same machine. The actuating force is secured by connecting the control valve lever to any speed indicating mechanism on the driven machine.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

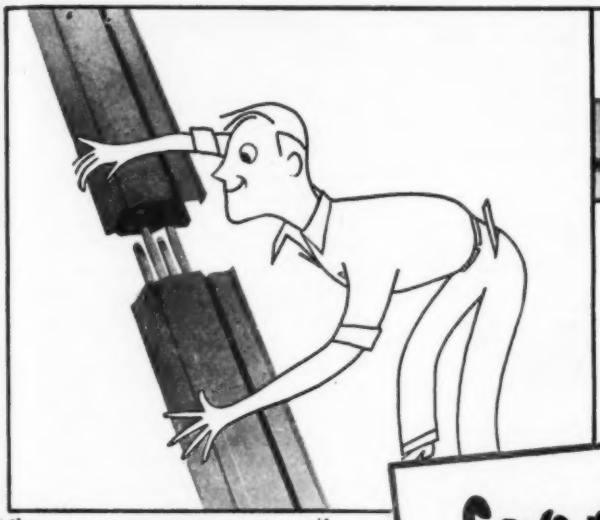
325—DEFECTIVE TUBES LOCATED WITH SCALE INDICATOR

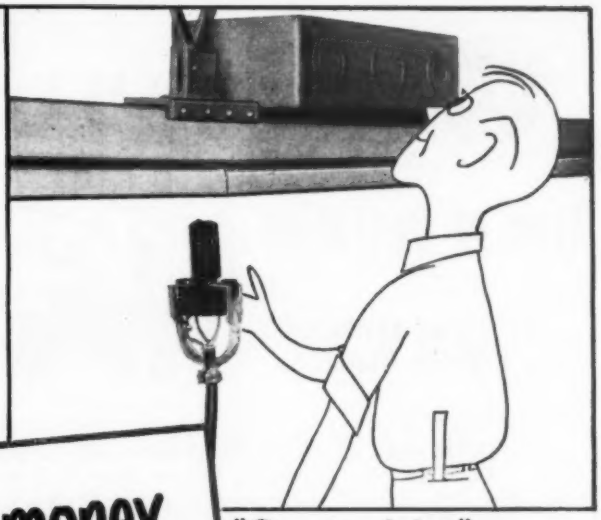
Boiler tube scale thickness indicator is an electrical instrument for measuring the thickness of scale or other de-



posits on the inside of boiler tubes, water wall tubes or other straight or bent tubes or ducts of circular cross section. The indicator works on the magnetic induction principle and is independent of the material composi-

(Continued on page 146)





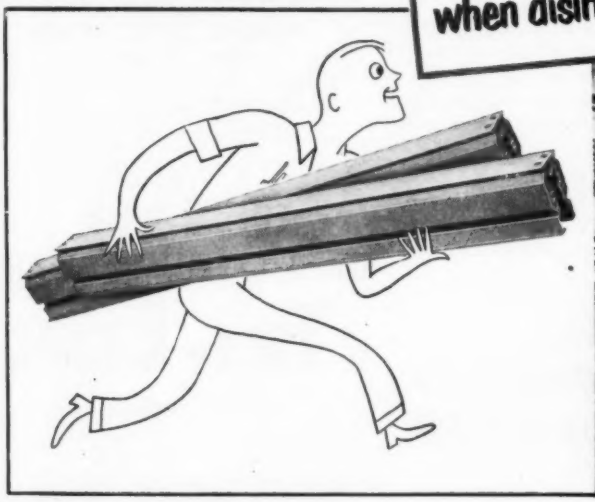
Save money these 3 ways when distributing power

"Quick-install-ability"
saves initial cost

LTG FLEX-A-POWER busways are pre-fabricated housings which are easily coupled in any arrangement and in runs of any required length. Time for installing is much less than for wiring and conduit.

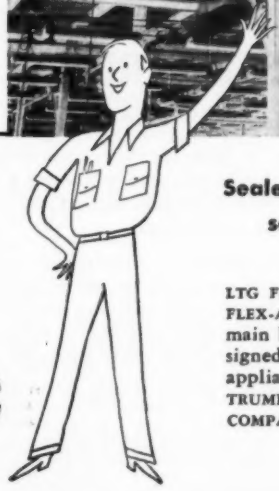
"Plug-in-ability"
saves time relocating machines

Take-off plugs or trolley can be inserted anywhere (no drop-out section needed for trolley). You can add or relocate loads without rewiring expense and without long extensions.



"Take-apart-ability" saves material expense

Whenever a *major* relocation of outlets is required, the entire FLEX-A-POWER system can be dismantled, removed to another location and re-installed with practically 100% re-use of materials.



Sealed Power Corp.
saves with Flex-a-Power

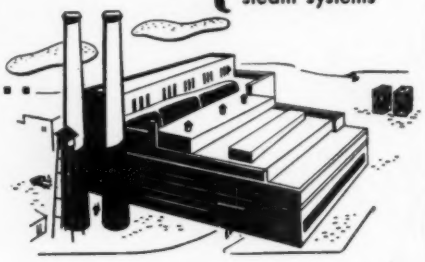
LTG FLEX-A-POWER, one of six forms of FLEX-A-POWER for various services from main breakers to individual loads, is designed for light-duty lighting, small tools, appliances. Write for Bulletin TEC-3, THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAIN OF NEW PRODUCTS

CORAVOL CASE HISTORY NO. 8 { 8th in a series describing CORAVOL results in steam systems

Type of Operation...



CENTRAL STATION POWER PLANT

OPERATING CONDITIONS: 4 condensing turbines with total capacity of 45,000 kilowatts. Turbine steam, 250 psi and 650°F.
Evaporation — 15,200,000 lbs. per day.
Make-up, distilled water, 0.5% of evaporation.

PROBLEM: Deterioration of metal in deaerating heater and boiler feed pumps. Heavy rust deposits in high pressure heater and surge tank.

CORAVOL STARTED: July 1943.

RESULTS: pH of condensate raised from 6.8 to a range of 7.4 to 7.8. No further damage to trays in the deaerating heater. No deposits of iron oxide in high pressure heater or in surge tank. Pumps operated continuously since 1943 with no loss of capacity or replacement of parts.

USER COMMENTS This 45,000 KW plant operated for 33 consecutive months with an average capacity factor of 110% or an average load of more than 49,000 KW for 24,000 consecutive hours.

CORAVOL (the original* AMINE PROCESS)

PROTECTS THE INACCESSIBLE PARTS OF YOUR STEAM SYSTEM FROM CORROSION

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of chemical treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete *free* data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

714 Washington Street Kansas City 6, Missouri

(Continued from page 144)

tion of the deposit. In making tests, an electro-magnetic probe head is guided through and held against the inside of the tube by means of guide wheels and is fed down the tube with a graduated spring steel tape which is rigid enough to keep the feet on the desired face of the tube. Provision is made to quickly rotate and lock the head in the various positions. The two feet in the probe head bear against the face of the tube and indicate the distance in thousands of an inch between the feet and the metal of the tube. The meter used is provided with an expanded type of dial so that thin deposits can be easily read to the nearest thousandth of an inch. The usual range of the meter is from 0 to 100, in thousandths of an inch. Haskins Turner Co.

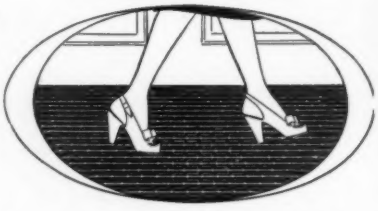
For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

326—SPEED CHANGES ARE FEATURE OF D-C MOTOR

One to thirty horsepower, direct-current motors, in frames 203 to 365, are available for constant, adjustable,

(Continued on page 148)

THE **SAFE** OPEN STEEL FLOORING IS **TRI-LOK**



No object over ½ square inch can pass through super-safe U-Type Tri-Lok Flooring. Fabricated without bolts, rivets or welds, it is unsurpassed for plant installation, walkways, loading platforms. Efficient distribution of concentrated loads . . . maximum free opening for light and air. Write for Bulletin JY 1140.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

A STACK THAT REALLY IMPROVES YOUR BOILER *Efficiency*

The Stack, fan and breeching are each only a *part* of an induced draft system. Separately built, they do not always provide the coordinated effort necessary for the most efficient draft that is possible.

Prat-Daniel Fan Stacks, however, offer an integrated induced draft system, combining the three elements of stack, breeching and I.D. fan, into one complete induced draft unit, each component designed to work with the other to produce the highest efficiency.

Prat-Daniel Fan Stacks are built to give your boiler a predetermined draft without excessive "safety factors" necessary with un-coordinated systems. They are completely fabricated and guaranteed by one responsible company . . . a company that has been designing and manufacturing draft-producing equipment for over a quarter of a century.

Write for the Prat-Daniel catalog on Fan Stacks.

Project and Sales Engineers

THE THERMIX CORPORATION
Greenwich, Conn.

Canadian Affiliates
T. C. CHOWN, Ltd., 1440 St. Catherine St. W., Montreal 25, Quebec

PRAT-DANIEL CORPORATION

69-2 WATER STREET — EAST PORT CHESTER, CONN.

DESIGNERS AND MANUFACTURERS OF POWER PLANT EQUIPMENT FOR OVER 25 YEARS

Coe Drainators incorporate NO MOVING PARTS in their construction which can wear and require replacement.

Air binding is eliminated as large volumes of air and non-condensible gases pass through Drainators with condensate.

Visible indication of operation is afforded in the gauge glass.

There is no variation in heat transfer as Drainator's continuous operation prevents the accumulation of condensate and air. Consistent high efficiency is maintained.

Drainator installations use simple "straight-through" piping. No by-pass or extra fittings are required.

YOU'LL BE WISE TO *INSTALL* COE DRAINATORS

SAVE THESE TWELVE PARTS

The Coe Drainator is unusually dependable in operation and REQUIRES NO BY-PASS.

The installation of the twelve customary by-pass parts shown here is eliminated.

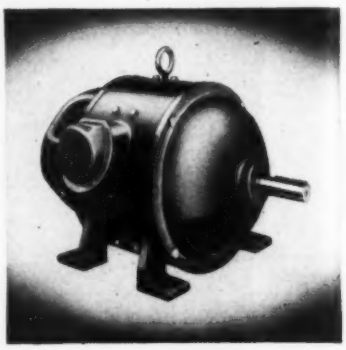
WRITE FOR *DRAINATOR CATALOG*

***The* COE MANUFACTURING CO.**

502 BANK STREET • PAINESVILLE, OHIO

DRAINATOR-THE ADVANCED STEAM TRAP

or varying speed applications—for either continuous or intermittent service. Depending upon the use intended, these life-line motors can be sup-



plied with shunt, compound, or series windings. They are designed for operation from 115, 230, 550, or 660 v. Westinghouse Electric Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

327—ANTI-STATIC DEVICE PROTECTS PERSONNEL

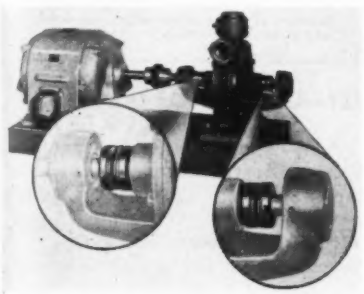
In order to protect personnel against static electricity explosions a new anti-static device has been introduced by the Walter G. Legge Com-

pany, Inc. The product is a grounding device that personnel wear to overcome a shortcoming in the effectiveness of conductive floors. It is designed to supplement the protection of conductive floors in locations where static sparks can create an explosion. The grounding device assures a positive electric contact between the body and the floor so that static charges are drained off. A leg garter of flexible material which makes con-

tact with the skin, is connected by a flexible bead-chain to a floor contact pin that clips on the sole of the shoe, and maintains electric contact with the conductive floor. This arrangement provides the unbroken skin-to-floor "escape path" that static currents need to be drained from the body and carried off through the floor. And the location of the contact pin on the shoe sole overcomes the insulating effects of shoes and stockings.

328—NEW LINE OF BOILER FEED PUMPS RELEASED

Development of a new line of condensate and boiler feed pumps feature 100% maintenance-free operation. The



new pumps include both mechanical seals which eliminates pump packing, and permanently lubricated ball bear-

Dutton
BOILERS
SINCE 1880

"ECONOMIST"
GAS - OIL
HAND - STOKER

The time-tested HRT type modernized by Dutton into one fully portable unit. Bricked and and insulated in steel case at factory; no special foundation needed. High efficiency and low fuel cost. Write for catalog.

Nation-Wide Sales and Service Engineer Organization

HOT WATER AND STEAM GENERATORS FOR HEATING PROCESSING OR POWER
THE C. H. DUTTON COMPANY
628 GIBSON ST. KALAMAZOO, MICH.
SERVING INDUSTRIES FOR 70 YEARS

now it can be told-
metallizing
stops corrosion

. . . not for one, two, or even ten years—*but from 20 to 50 years* under severe service conditions!

Storage tank, Riverhead Water District, Riverhead, Long Island, showing riser pipe being metallized in 1940. Tank interior metallized in 1933.

We have long known that metallizing stops corrosion. Accelerated tests in the laboratory demonstrated that much. But we wanted a good backlog of actual applications in the field before telling maintenance men, *for sure*, just what metallizing would actually do to help solve specific corrosion problems for them.

For instance

They used to hot-coat the interior of the water storage tank, shown above, every 5 or 6 years—an unsatisfactory service life. So, in 1933 they metallized pure zinc on the inside walls of the tank, and also on a small section of riser pipe exterior as a test. Remainder of the tank, pipe and structure was painted. By 1939 the paint had scaled badly, but the metallized test panel on the riser pipe was in excellent condition. In 1940 the tank interior was inspected. All pitting and corrosion had been stopped completely by the metallized coating. That looked like proof enough, so they metallized the entire pipe exterior with a coating of zinc, followed by a coating of aluminum; then painted it for appearance.

Now, nine years after, the paint has started to peel from weathering. But—even where it has peeled, the metallized coating is as sound as when it was first put on despite constant exposure to the salt atmosphere on Long Island! And under the metallized surface, the steel pipe has not been attacked at all.

More examples

Users report a wide range of jobs where metallizing affords excellent protection against corrosion. Here are a few:

furnace parts • exposed steel structural members • refrigerator cold plates • fan wheels tanks, of all kinds • iron heat-exchanger headers • vapor degreasers • boat bottoms, barges, dam gates • baking ovens • motor parts • outdoor capacitors, transformers

. . . and many, many others. We have prepared an 8-page booklet that pictures some more; includes specifications, spray tests, life expectancy charts. It's free—send for yours, today.

Other uses

In addition to its value in the corrosion field, your same Metco gun can be used to spray many metals for repairing worn machine parts . . . building up undersize areas . . . getting equipment back in service fast, often for as little as 10% of replacement cost. *Metallizing is profitable.* Get the whole story today.

FREE BULLETIN—Bulletin 62—pictures many different types of metallizing jobs. Send off the coupon now.

R. J. McWaters
Metallizing Engineering Co., Inc.
38-17 30th St., Long Island City 1, New York

Please send me Bulletin 62.

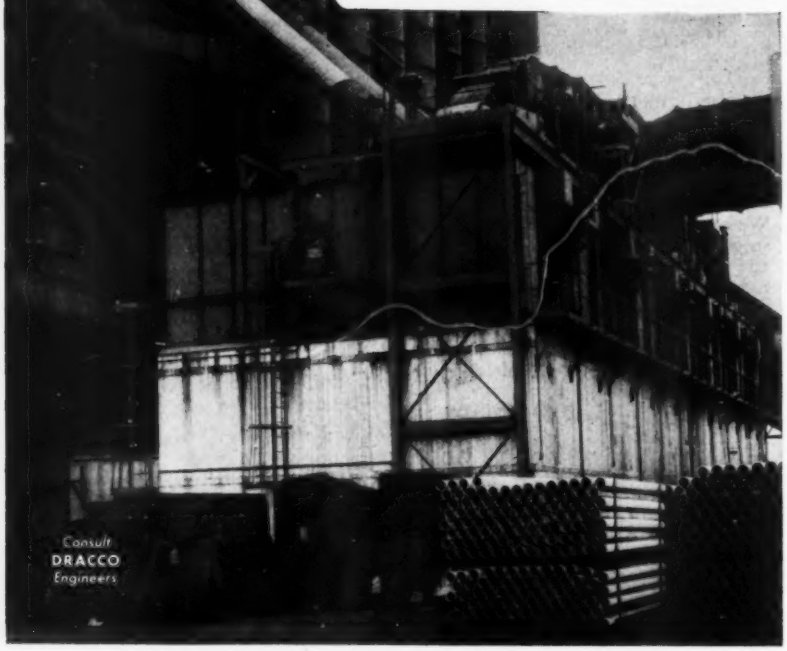
NAME_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

Metco—Reg. U. S. Pat. Off.

METALLIZING ENGINEERING CO., INC.
38-17 30TH STREET METCO LONG ISLAND CITY 1, N. Y.

DRACCO DUST CONTROL

Recovers 1/2 to 1%



The installation illustrated has been in operation a year and has established an unusual record of recoveries — IT HAS SAVED MONEY. There are six DRACCO Dust Control Units, capable of handling 162,000 to 180,000 C. F. of air per minute. It is used after a mill drying system where 5 to 6% moisture is removed from the coal at the same time it is being pulverized. 1/2 to 1% of the coal ground is recovered by the DRACCO Dust Control System. The saving is substantial because 180 tons are pulverized per hour. DRACCO Dust Control replaced a wet wash system.

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio *New York Office: 130 W. 42nd St.*

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

ings. The mechanical seal does not leak and cannot score the pump shaft. Special design feature of the seal is automatic adjustment of seal face tension proportional to internal pump pressure, plus ability to take up for nominal axial misalignment. A unique characteristic of this seal is its ability to run dry if necessary for several hours without burning up the seal faces. Normal life expectancy is two years and seal replacemnt in the field is no more difficult than replacing other internal pump parts. Fred H. Schaub Engineering Co., Inc.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

329—GEARMOTOR UNITS HAVE SPEEDS OF 780 TO 7.5 RPM

A new gearmotor, manufactured in 17 sizes, provides single, double, and triple reduction units having output speeds from 780 rpm down to 7.5 rpm. Integral horsepower ratings from 1 through 75 hp are available. A wide

selection of motor enclosures includes the conventional open drip-proof, splash-proof, totally enclosed, and explosion-proof construction. A-c and d-c motors of all types, as well as motors having special electrical characteristics, are available to meet unusual installation and application requirements. Foote-Bros. Gear and Machine Corp. and The Louis Allis Co.

330—FRACTIONAL HP UNITS ARE SMALL AND COMPACT

Reeves Pulley Company has announced a smaller and more compact version of the motodrive in fractional horsepower sizes. Like the larger models these units combine motor, speed varying mechanism, and reduction gears in one package. The horsepower sizes are 1/4, 1/3, 1/2, and 3/4. Ratios of stepless speed variation within 10:1 are available for each size. Designated as the "1000 Series" these new units are as small in height at 9 5/8 in. in horizontal position and

(Continued on page 152)

4 *ways to* MAINTAIN HIGHEST EFFICIENCY THROUGH THE WINTER

Do your boilers take a beating in the wintertime? Then right now is the time to do the little jobs that will keep their operating efficiency up where it belongs.

Because trouble generally starts when the going is toughest, a little maintenance now will go a long way toward insuring good operation for the rest of the season. The Plibrico products shown here make boiler operation better and maintenance easier. Send the coupon for more information.

1

Plibrico Jointless Firebrick

— the ideal material for refractory maintenance. Avoid the possibility of disastrous shut-downs by keeping your linings in good repair throughout the winter. Patch with jointless Plibrico at the first sign of refractory trouble.

Plibrico is made in three grades. Packed in convenient 100-lb. cartons containing ¾ cu. ft.

2

Plibrico Castable Refractories

The eleven grades of Plicast provide a castable refractory material for nearly every purpose. Used for door liners and other special shapes; ideal for installing and repairing tube decks. A Plicast gas-tight rear arch can be installed in a week-end. Just add water, mix and pour.

Packed dry in 100-lb. bags. Weight approx. 110 lbs. per cu. ft.

3

Pliseal Boiler-Wall Coating

Coat the outside of brick settings with Pliseal. It saves fuel by sealing the joints and cracks in the brickwork, preventing the infiltration of cold air into the furnace. It waterproofs the setting and preserves the brickwork. Easily applied with a trowel. Will not crack, peel, or blister. Pays for itself in a few months with increased efficiency.

Packed in 5, 30, and 55-gal. drums. 5 gals. covers 60 sq. ft. ⅛ in. thick.

4

Hyrate and Demon Cements

These high-temperature cements are unexcelled for pointing up cracks and minor repairs. Hyrate is a heat-setting cement in dry, powdered form for extreme combustion conditions. Packed in 100-lb. bags.

Demon Air-Set is a popular cement in moist, plastic form ready for immediate use; easy to use; sets cold on exposure to air, forming an exceptionally strong bond. Packed in 50-lb. pails and 100, 200, and 500-lb. drums.

PLIBRICO JOINTLESS FIREBRICK CO., 1802 Kingsbury St., Chicago 14, Ill.

Please send bulletins on:

- ☐ Plibrico Jointless Firebrick
- ☐ Plicast Castable Refractories
- ☐ Pliseal Boiler-Wall Coating
- ☐ Hyrate and Demon Cements

Firm_____

Name_____ **Title**_____

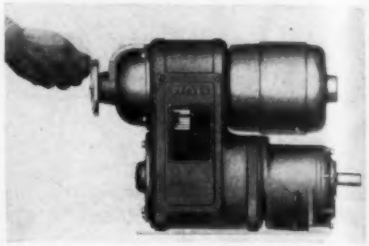
Address_____

No. Boilers_____ **H.P.**_____ **Type**_____

Repairs needed when?_____

(Continued from page 150)

16⅞ in. in vertical position. This compactness offers many advantages in extending accurate, stepless speed adjustability to machines. A total of

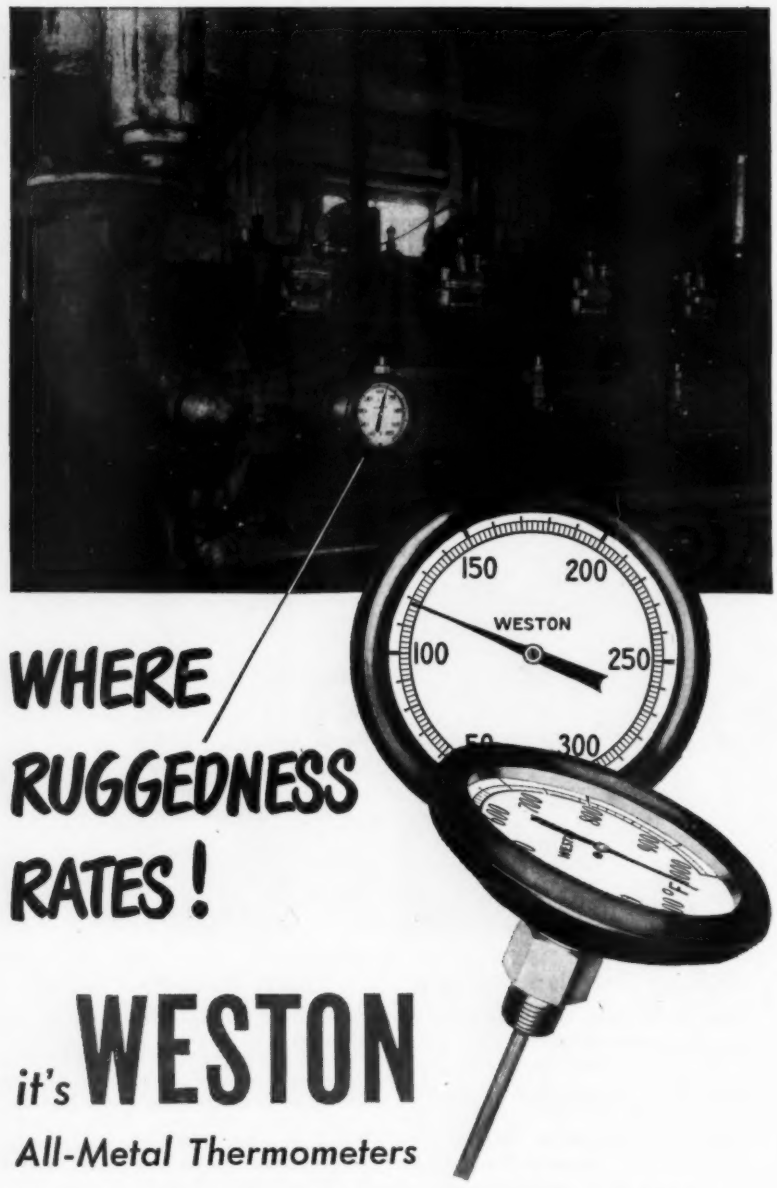


24 different assembly combinations for vertical or horizontal floor mounting or horizontal wall mounting are available for each horsepower rating.

331—3000 AND 4000 LB FORK TRUCKS ARE AVAILABLE

In designing a new 3000 and 4000 lb fork lift truck features that would contribute to efficiency, economy, safety and operator convenience, and comfort were incorporated. A unit-welded, heavy-gage all-steel frame contains an integral hydraulic tank and a steel plate bumper at the rear to provide effective counterweight. Heavy

(Continued on page 154)



WHERE RUGGEDNESS RATES!

it's WESTON

All-Metal Thermometers

Where the going is tough, WESTON thermometers get first call. Their rugged construction—all-metal throughout—enables them to stand up on pumps, compressors and mobile units. And the big, bold dials are easy to read—quickly and accurately! There are many types, stem lengths and scale ranges from which to choose. Ask your jobber or local WESTON representative, or write for Thermometer Bulletin. WESTON Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey.

CONTACT-MAKING models for alarm or control purposes. MAX-MIN models to indicate highest or lowest temperature reached.

WESTON *Instruments*

CONTINENTAL

THE HOTEL OF *Star Features*

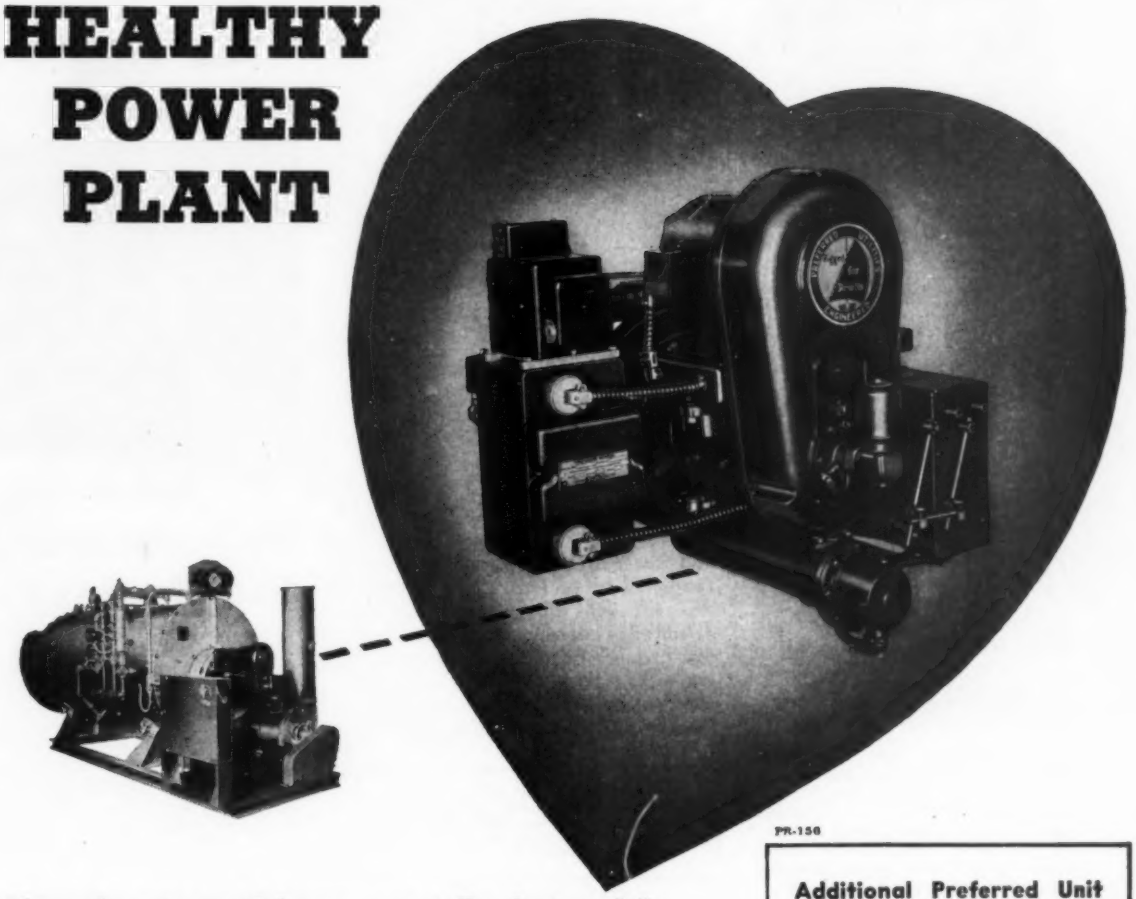
Hotel Continental has everything for enjoyment of living at its best; all rooms are outstandingly gay and attractive. . . . Guests enjoy all club facilities, including the swimming pool, Turkish baths and Swedish massage. . . . Perfect location at 11th and Baltimore. Rooms from $3

Direction SOUTHWEST HOTEL INC. H. Grady Manning, Founder

R. E. McEACHIN Managing Dir.

KANSAS CITY MISSOURI

This Steady Heart Means a HEALTHY POWER PLANT



PR-150

The only rotary oil burner specially designed for firing in the elongated furnace of a "packaged" boiler.

The Preferred Horizontal Rotary Oil Burner is the "heart" of the Preferred Unit Steam Generator . . . a heart that steadily supplies the correct amount of oil for economical combustion.

Constant volume of fuel oil—regardless of variations in temperature, pressure, or viscosity of the oil—is assured by the patented "Voluvalve" fuel regulation and the dual pump reservoir.

Ignition is reliable and automatic, due to the low-voltage hot-wire igniter assembly. Thorough atomization of heavy oils is provided by the higher cup speeds, made possible by the high-speed belt drive.

Maximum combustion efficiency is achieved throughout the entire throttle range by an air control device coordinated with oil feed control. Automatic high-low operation is standard on all Preferred Unit Steam Generators of 100 H.P. and over, and is also available on smaller units.

Preferred's Bulletin 175 tells the complete story of the Preferred Horizontal Rotary Oil Burner . . . and Bulletin 1000-E describes in detail other engineering features of the Preferred Unit Steam Generator.

Additional Preferred Unit Steam Generator Features

1. Induced (pull-through) Draft—eliminates necessity of building expensive stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation — even with Bunker C or No. 6 oil.

3. Four-pass Down-Draft Gas Travel—results in maximum heat absorption.

4. 80% Minimum Thermal Efficiency—proved and guaranteed.

5. Full Range of Sizes—from 20-500 H.P., and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 H.P., 15 lbs. pressure.

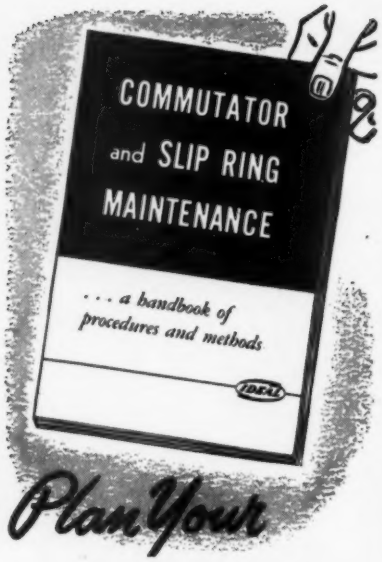
Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.

IP-2-50

WRITE FOR BOTH BULLETINS TODAY.

PREFERRED UTILITIES MANUFACTURING CORPORATION, 1860 Broadway, New York 23, N. Y.

PREFERRED UTILITIES MFG. CORP.



Plan Your

MAINTENANCE PROGRAM with this New FREE HANDBOOK

The Commutator and Slip Ring Maintenance methods and procedures described have been proven over many years in hundreds of operations. They are based upon conclusive evidence compiled by well-known authorities. Concise, practical information tells everything you need to know about scores of commutator and slip-ring problems:

- **Commutator and slip ring troubles and how to correct them**
- **Brush maintenance and operating procedure**
- **General maintenance procedure**
- **Condensed data on IDEAL commutator and slip ring maintenance products**

Dozens of illustrations and diagrams show operations described. Every operating and maintenance man should have this guide to better, more efficient, lower cost maintenance. Mail coupon for your free copy.

LOOK TO IDEAL AS MAINTENANCE HEADQUARTERS FOR:

Resurfacers • Brush Seaters • Commutator Cleaning Stones • Grinders Mica Undercutters • Saws and Milling Cutters, etc.

MAIL FOR FREE HANDBOOK

IDEAL INDUSTRIES, Inc. (IDEAL)
1023 Park Avenue, Sycamore, Ill.

Please send me your free handbook on commutator and slip ring maintenance.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ **ZONE**___ **STATE**_____

(Continued from page 152)

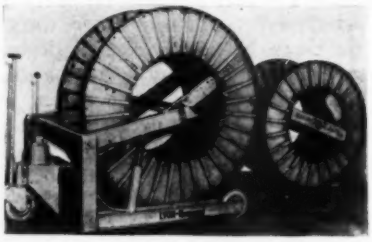
formed channels welded into a unit assembly form the upright guides. The location of the pivot minimizes the increase in over-all height when tilting. Pivot, tilt, and hose connections are designed for quick interchangeability on the job. With 83 in. over-all height standard telescoping lift is 126 in., single lift 64 in.

and where overhead obstructions are a factor, 63 in. of free lift is provided. The lift and tilt mechanism is hydraulically operated and employs a low pressure hydraulic system providing safety, positive control, and low maintenance. Baker Industrial Truck Division, The Baker-Raulang Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

332—ALL SIZES OF CABLE REELS HANDLED BY LIFT TRUCK

A cable reel truck has been designed to handle reels of various diameters and widths without requiring any adjustment. This truck is suitable to handle the largest reel and will also



pick up and transport smaller ones. The lifting arrangement incorporates two hydraulic hoists which raise the carrying arms of the truck. One model provides a 23 in. lift and will handle reels from 24 in. to 60 in. in dia and up to 36 in. wide and has a 4000 lb capacity. Other trucks can be furnished in capacities from 2000 to 10,000 lb. This unit has a fifth wheel star ar-

(Continued on page 156)

What About the

Reputation of the Builder

A good reputation is more precious than great skill and fine quality. Strangely enough, a good reputation cannot be bought, nor is it ever offered for sale. It can only serve as a bond of human confidence so vital in modern business transactions. For seventy years Layne has been building a good reputation. The task isn't complete yet, nor will it ever be. But the job is far enough advanced to be bringing in many fine orders for Layne equipment and services. As a basic policy, it has aided Layne to become a great world-wide organization.

When you buy a Layne Well Water System or a Layne Vertical Turbine Pump, you are getting the assurance that if Layne equipment does not make good—the Layne Organization will!

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Layne's planning supplements that of your own engineers, but Layne's work is complete from the test well to the finished, and in operation units—proven in production volume and fully adjusted for the task to be performed. Such a service is widely welcomed by the Nation's greatest—and sometimes smallest cities and industrial plants. It is an overall service that saves time and gives universal satisfaction. For further information, literature, etc., address

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BUILDERS OF HIGH EFFICIENCY

WELL WATER SYSTEMS

ASSOCIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn., • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wisc. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • The Layne-Texas Co., Ltd., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Minnesota Co., Minneapolis, Minn. • International Water Corporation, Pittsburgh, Pa. • International Water Supply, Ltd., London, Ont., Can. • Layne-Hispano Americana, S. A., Mexico, D. F. General Filter Company, Ames, Iowa

THIS TRUE BALL JOINT

Gives DART UNIONS

TIGHTER FIT
LONGER LIFE

Drop-tight! The non-corroding bronze seats of a Dart Union are precision-machined to a true ball joint. It's easy to make a Dart drop-tight without excessive wrenching.

Use Again and Again! They're less expensive, too. They uncouple easily—seats are uninjured—so you use them again and again.

Practically Indestructible! What's more, body and nut are made of practically indestructible air-refined malleable iron.

Remember a Dart Costs Less in the long run.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

Monsanto SANTOSITE stops oxygen corrosion in boilers

Santosite (Monsanto sodium sulfite anhydrous, technical) removes dissolved oxygen from boiler feed water . . . puts an end to steam plant damage and shutdowns due to oxygen corrosion. Santosite is economical . . . efficient . . . easy to apply.

If oxygen corrosion is a problem in your boilers, you will profit from reading Monsanto Technical Bulletin No. O-26. For your free copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk B, Organic Chemicals Division, 1743 South Second Street, St. Louis 4, Missouri.

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A COMPLETE, COMPACT Combustion Unit
to fire boilers and furnaces
from 100 Developed HP upwards

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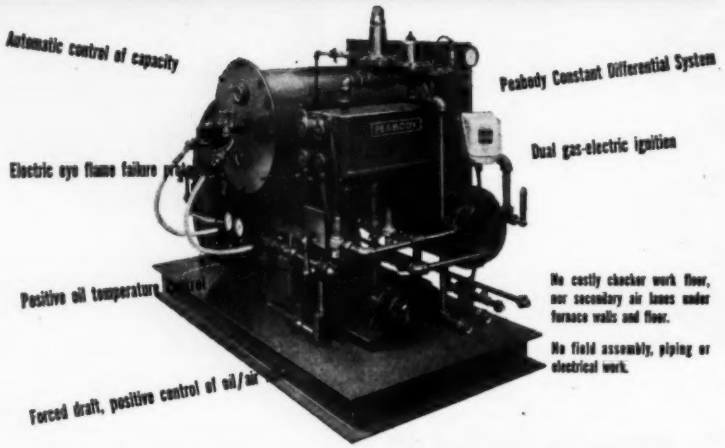
Automatic Burner


Automatic control of capacity
Peabody Constant Differential System
Dual gas-electric ignition
No costly checker work floor, nor secondary air lanes under furnace walls and floor.
No field assembly, piping or electrical work.

The Peabody Automatic Burner is a complete self-contained combustion system that pumps, heats and burns heavy Bunker "C" or lighter fuel oils. No other auxiliary equipment is needed. Shipped as a complete factory-mounted unit, this new Peabody development eliminates field engineering and special construction. Listed by the Underwriters Laboratories and equipped with all modern safeguards for manual or fully automatic operation.

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REFINERY BURNER FOR GAS AND OIL
COMBINED GAS AND OIL BURNER
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580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

OFFICES IN PRINCIPAL CITIES 205

(Continued from page 154)

rangement to provide maximum maneuverability with 10 in. dia wheels incorporating roller bearings. A single speed hydraulic hand pump provides power to elevate the lifting arms while lowering is controlled by a finger tip release lever. The towing handle has a spring arrangement which keeps it in an upright position when released. Lyon-Raymond Corporation.

333—POLE DERRICKS ARE MADE OF ALUMINUM

Utility type pole derricks are now being manufactured of aluminum by two midwestern companies, Eagle Manufacturing Co., (a division of The Four Wheel Drive Auto Co.), and American Coach & Body Co. This newly-available equipment, which is

mounted on trucks for the placement of telephone and utility poles, represents a weight saving of about 50%. Light weight is important because it is necessary for utility truck crews to assemble and disassemble the unit frequently. Strength is not sacrificed, however, for ease of handling and according to the results of comprehensive tests, the aluminum pole derricks now available equal the strength of the equipment that they replace. Aluminum Company of America.

ASSISTANT PLANT ENGINEER

with at least 3 years experience in industrial plant Maintenance; emphasis on electrical maintenance. M. E. or E. E. degree required. Give full details experience, education, age, salary in first letter.

Write Box 2

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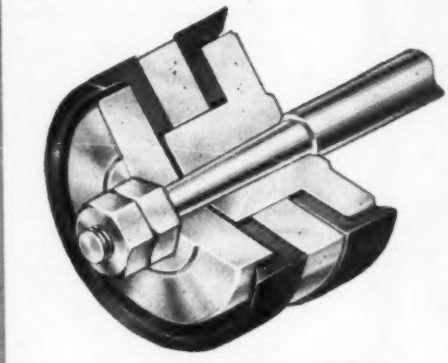
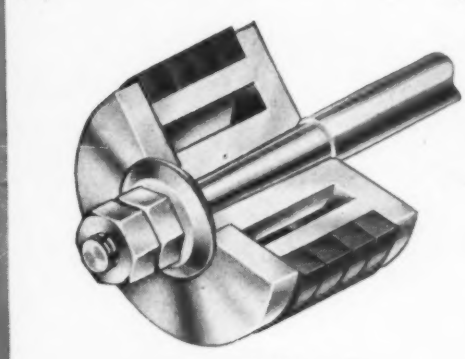
St. Joseph, Mich.

TWO WAYS TO PACK PISTONS:

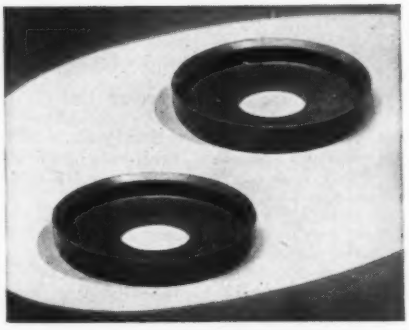


Johns-Manville Moulded Packing Cups



Conventional type piston packing

— Which does the better job?



RECOMMENDED FOR PISTONS IN

Reciprocating Pumps	Compressors
Hydraulic Lifts	Governors
Hydraulic Jacks	Power Shovels
Hydraulic Presses	Grease Guns
Drilling & Boring Machinery	Air Chucks
Air Brake Cylinders	Grinders

Valves (hydraulic or air operated)

BOTH THE PACKINGS shown on these two pistons will do a job. But the piston on the left will operate more efficiently and more economically because it is designed for Johns-Manville Moulded Packing Cups.

Design engineers are expressing a growing preference for these custom-made cups for two reasons: (1) They practically eliminate slippage past the piston. (2) They require less frequent replacement in service.

Johns-Manville Moulded Packing Cups operate like this: Each cup is designed with a flexible lip, which, under discharge pressure, forms a tight seal. On the reverse stroke, the lip relaxes. This action, plus their precise fit, lowers friction and wear on liners and reduces the amount of power required for the stroke.

Wherever Johns-Manville Packing Cups have been used—against water, oil, air, and other liquids and gases—they have proved to be a good investment by increasing efficiency and lowering operating costs. If you design or manufacture any of the equipment listed at left, write for further information about these custom-made cups. Address Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville *Packings and Gaskets*

Control Air Flow this New Easy Way

Turn a few of those tidy fins and beam a supply of heated air to that chilly worker at the end of the bench —adjust a few more and blanket that drafty doorway—all while your dependable Trane Model H Unit Heater handles its regular heating duties.

This fingertip control is now easily available because Trane engineers have solved the heat diffusion problem on horizontal discharge unit heaters with the new, completely adjustable Louver Fin Diffuser. With this smooth device, not only the up and down flow of air is under control, but also the side to side sweep—left and right.

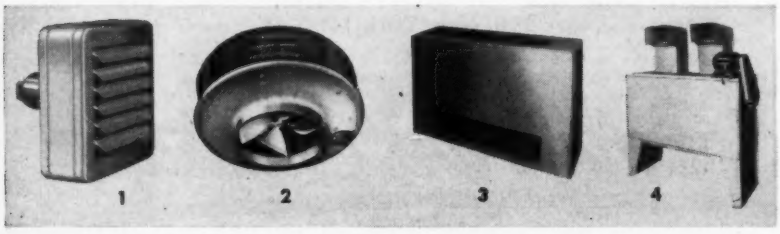
Individual fin and louver adjustability permit an infinite number of diffusion pattern possibilities. Simple and rugged in design, highly efficient in performance, quick and easy to install.

You can now really aim to please by delivering the exact amount of air you want to the particular spot where you want it.

Ask the Trane sales engineer in your area for complete details about this new angle on diffusion—the Trane Louver Fin Diffuser.

THE TRANE COMPANY, LA CROSSE, WIS.
EASTERN MFG. DIVISION, SCRANTON, PA.
Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties—IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

Here are the "Four Freedoms" of unit heater selection: 1. *Twenty-four* sizes of horizontal units; 2. *Sixteen* sizes of vertical projection units; 3. *Twenty-four* combinations of compact force-flo heaters; 4. *Sixty-eight* standard arrangements of blower units.



NEW BULLETINS

(Continued from page 16)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 37.

diagrams show how a corrected record is automatically and continuously produced, and how pressure and temperature are compensated. Hagan Corp.

Level Meter (R) New 24 page bulletin describes magnetic tape-and-drum, electronically transmitting, ball-float, pneumatic, and differential pressure units; V-notch weir and Parshall flume flowmeter instruments; and chemical service sight gage glasses. Detail views are shown for numerous instrument features with accompanying explanations. Fischer & Porter Company.

Pressure Gages (S) Illustrations and descriptive matter, pertaining to features and operation principles of versatile pressure gage, are contained in a new 16 page catalog. The movement of the delicate working parts is thoroughly explained. Outline dimensions are included along with several listed gage accessories. Helicoid Gage Division, American Chain & Cable Co., Inc.

Electronic Control Case Studies (T) Forty-five case studies are presented in a pocket size booklet that covers the application and operation of electronic controls. The booklet, entitled "Cutting Production Costs with Electronic Controls" will be invaluable to engineers desiring information on how the electronic control can be adapted to count, guard, sort, weigh, measure, maintain liquid levels, and countless other tasks. Photoswitch Incorporated.

Counting and Recording Units (U) Equipment for accurate counting and recording of production units is described and illustrated in a new six page folder. Twenty models are listed —standard tripped, motor driven, ticket printing, automatic stopping counters, and explosion proof units. The Richardson Scale Company.

MATERIAL HANDLING

Handling Methods (V) Modern methods, which brought about substantial savings in handling materials for one specific company, are discussed in detail in a new bulletn. On-the-job photographs illustrate the various problems overcome to improve handling efficiencies. Towmotor Corporation.

Lift Trucks (W) Action photographs and description of a new 2000 lb capacity lift truck are covered in an eight page bulletin. Numerous features are illustrated and explained such as: cooler operating temperature; larger, long-life clutch; double-acting hydraulic tilt control; better braking power; increased speed; and larger gasoline tank. Specifications are included. Hyster Company.

Material Handling (X) Illustrated new 20 page booklet describes briefly

(Continued on page 160)

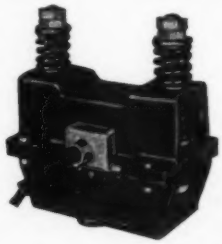
No Pounding
No Sledging
No Damage

to Bins, Hoppers and Chutes when they're equipped with

SYNTRON

"Pulsating Magnet"

ELECTRIC VIBRATORS

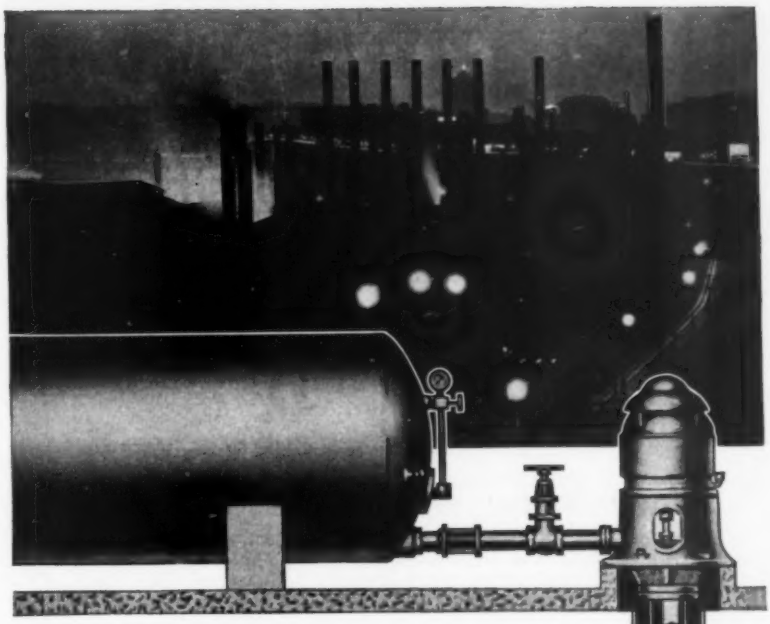


Banged-up and dented bins and hoppers cost money in replacement and in man hours lost — and that's where SYNTRON Vibrators come in. They eliminate the arching and plugging that takes a man's time to pound, and damage, those bins and hoppers.

Write — giving the details of your troublesome bin, hopper or chute — our Engineering Department will be glad to give you their recommendations.

SYNTRON CO.

425 Lexington, Homer City, Pa.



GUARD AGAINST WATER SHORTAGE

Is YOUR plant protected against water shortage? Peak load demands on municipal water works with inadequate pumping, or reservoir facilities, can slow down, or stop, manufacturing operations.

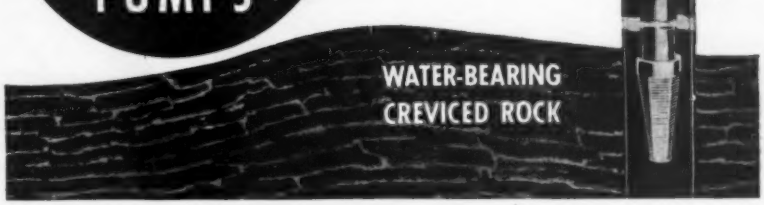
To avoid that costly possibility, many plants installed Deming Deep Well Turbine Pumps. The vertical, multi-stage construction of these units make it possible to utilize underground water sources at almost any depth below the surface.

In addition to protection against water shortages, many owners of Deming Deep Well Turbine Pumps report savings up to 60% over high rates of central station water works in their areas.

DEMING
Water Lubricated
TURBINE PUMPS

For more information on the advantages of Deming Deep Well Turbine Pumps for factory water supply and other uses, write for free Bulletin No. 4700-8.

THE DEMING COMPANY
527 BROADWAY • SALEM, OHIO



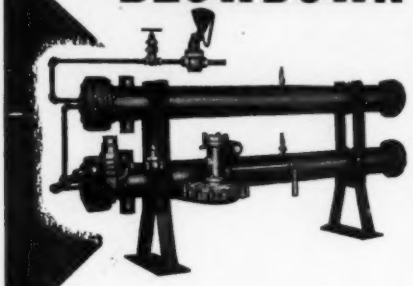
HENSZEY CONTINUOUS BLOWDOWN

Prevents PRIMING

Prevents FOAMING

Prevents SLUDGE

Prevents SCALE
(with simple chemical treatment)



AN INVESTMENT THAT PAYS 50% INTEREST

The Henszey System automatically keeps boiler water concentrations within safe margins. This is accomplished continuously WITHOUT HEAT LOSS. Maintain clean, efficient boilers for substantial savings in fuel, equipment and manpower.

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CONTINUOUS BLOWDOWN and BOILER PLANT SPECIALTIES
Boiler Feed Regulators • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PREHEATERS

(Continued from page 158)

the material handling and power transmission equipment employed in the grain and allied fields. Information covers: box car unloaders; car spotters; screw conveyors; bucket elevators; drives, both gear and chain; clutches; and couplings. Link-Belt Company.

Fork Trucks (Y) Attractive catalog just released covers the full line of this company's fork-lift trucks and towing tractors. Photographs of each size and style of truck are shown, with accompanying specifications. Various attachments such as cranes, rams, shovels, and rotating forks are illustrated. Clark Equipment Co., Industrial Truck Div.

Freight Elevators (Z) Ten illustrated sections in 44 page booklet explain the basic considerations involved when selecting freight elevators and necessary component parts. Subjects covered are: how to determine lifting capacity and size; types of elevator control systems; how to determine door operation method; standard freight elevator layouts; how to determine the type of elevator best suited to needs; budget price information; and typical and special installations. Westinghouse Electric Corp., Elevator Division.

Lift Truck Attachments (AA) Just released 28 page catalog describes attachments, tools, and accessories designed to lower cost and increase ease of handling materials with lift trucks, straddle trucks, and mobile cranes. Model views, diagrams, specifications, action pictures, cartoons, and explana-

TOUGH FLOOR PATCH

Repair holes, cracks, broken places in concrete floors, or resurface an entire area with durable RUGGEDWEAR RESURFACER. No chopping or chipping required. Merely sweep out spot to be repaired — mix the material — trowel it on. Holds solid and tight right up to irregular edge of old concrete. Used indoors or out. Dries fast.

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THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

tory text are employed to bring out various special-purpose feature additions to basic material handling machines. Hyster Company.

Pneumatic Conveying (BB) Principal component parts that make up a pneumatic conveying system are explained and well illustrated in a 24 page bulletin, just released. Numerous field installations are shown and described that cover a wide field of material handling. Fuller Company.

Coal Handling (CC) New bulletin contains descriptions of 14 case histories of coal handling and storage systems. Installations—based upon one of four basic types of storage handling systems—are described and explanations given on how each unit may be economically adapted to suit varying conditions of space, capacity, climate, and allowable initial cost. Cross sectional drawings and essential engineering data on each of the case histories are included. Gifford-Wood Co.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

POWER TRANSMISSION

Roller Chains (DD) Four available types of double pitch roller chains adaptable for drive and conveyor service are illustrated and discussed in a new bulletin. Dimension tables, price list, and recommended maximum work-

(Continued on page 163)

NON-FLUID OIL

TRADE MARK REGISTERED

Cuts Down Motor Short Circuits

Nine out of ten short circuits in ring oiling motors are due to oil escaping from bearings and soaking windings. The result is a "burn-out".

NON-FLUID OIL practically eliminates all oil-caused short circuits because it does not leak, creep or throw out of bearings. Motors run steadily with cool bearings and clean frames. You save money, too, because NON-FLUID OIL lasts longer and needs less frequent application. Also available are grades and densities of NON-FLUID OIL for all types of ball bearing motors.

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Eliminate costly repairs, fire hazards and work stoppages with **TORNADO*** High-Velocity Blowers.

Shoot a concentrated blast of clean, dry air into motor and equipment interiors to blow out all dirt, grit and greasy lint. Absolutely safe for intricate mechanisms.

Equipped with suction attachments, **TORNADO*** High-Velocity Blowers become versatile pack-carried vacuum cleaners.

BULLETIN 579 CONTAINS COMPLETE INFORMATION

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BREUER ELECTRIC MFG. CO.

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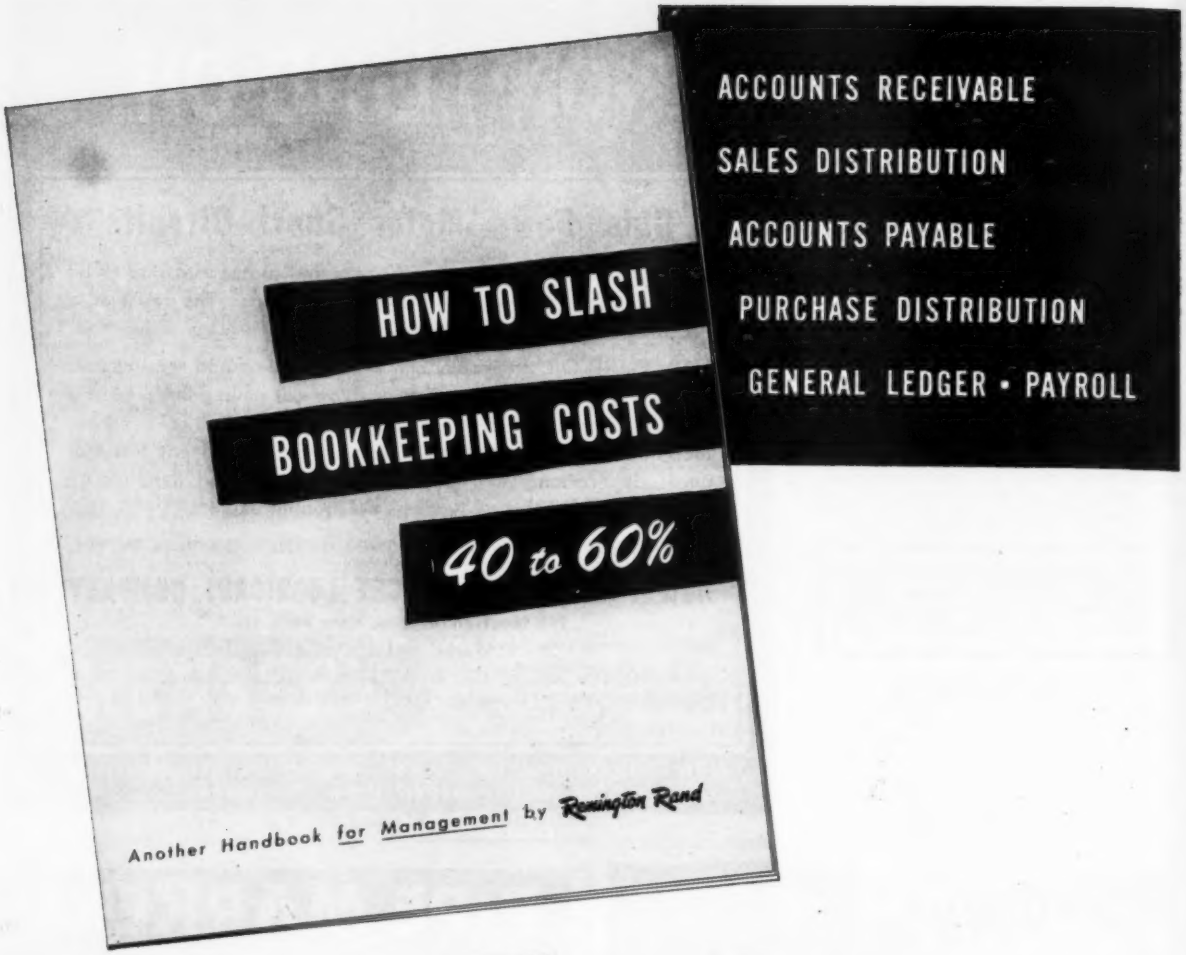

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can cost

a Fortune

yet it costs so little to correct with

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Used and specified on hundreds of new buildings—and installed on thousands of old buildings to prevent costly "Water Hammer"—the Williams-Hager Flanged Silent Check Valve will solve your problem, too! Write for new technical bulletin.

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(Continued from page 161)

ing loads are included to aid in proper selection of all types of chains. Baldwin-Duckworth, Div. of Chain Belt Co.

Gear Coupling (EE) Construction details of a gear coupling are illustrated and explained in a recently published bulletin. Dimensional data for couplings ranging in size from ¾ to 6 in. bore are included. Capacities, listed per 100 rpm, range from 4 hp for the smallest bore to 550 hp for the 6 in. bore. Sier-Bath Gear & Pump Co., Inc.

Cast Sprockets (FF) Dimensions, specifications, list prices, sprocket style, and all other necessary information are included in a bulletin just released. Of particular importance are the rules for selection, alignment, care of sprockets, and complete data on what should be considered when ordering sprockets. Chain Belt Company.

Roller Chain Application (GG) Material for a new 24 page bulletin, which covers roller chain applications, was assembled with the help and cooperation of roller chain designers throughout the country. Each application is described and illustrated both with photos and simplified working drawings. Innumerable field applications are shown for light and heavy duty work. Baldwin-Duckworth, Division of Chain Belt Company.

Silent Chain Drive (HH) New catalog features simplified selection of silent chain drives in three easy steps: (1) apply safety factor, obtained from table, to hp rating; (2) refer to "selection table" and satisfy hp rating and driven speed; (3) under "driven speed" select the nearest rpm required to obtain complete specifications on stock drives and chains. Whitney Chain & Manufacturing Company.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

PUMPS AND ACCESSORIES

Fire Pumps (II) Single stage and two-stage fire pumps, methods of drive, and applications are comprehensively covered in a multicolor illustrated bulletin. Drawings and dimensional data are set forth on both types of pumps. Selection charts cover capacity, heads, hp range, and rpm of each pump for electric motor, Diesel, gasoline engine, or steam turbine drive. Peerless Pump Division, Food Machinery and Chemical Corporation.

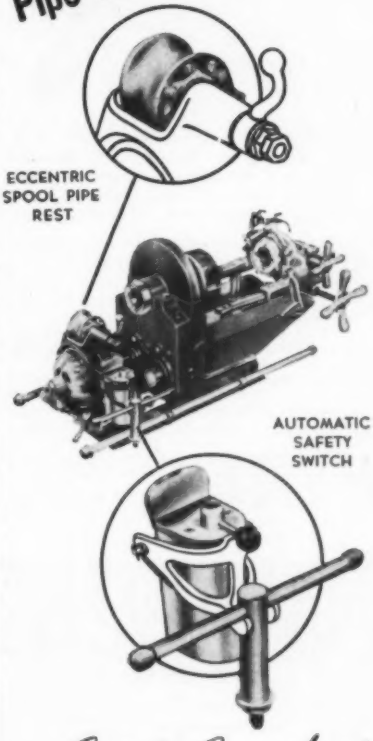
Sump Pump (JJ) Information is contained in a new bulletin that covers the features of a submersible all bronze construction floatless sump pump. Complete specifications and operating principles of the automatic floatless switch are given. Price list and pump capacity at various heads are included in table form. Kenco, Inc.

Rotary Pumps (KK) Drawings of six different types of rotary pumps along with a brief description of each are contained in a new bulletin, just released. The pump is designed to handle residual and distillate fuel oils, crude

Now Better than Ever

BEAVER Model-A

Pipe and Bolt Machine



Safe! Smoother!

Two new improvements—patents pending—have been added to further increase the safety, convenience and performance of the Beaver Model-A ⅛ to 2" Pipe & Bolt Machine—popular the world over for the past 19 years.

1. The new Automatic Switch Lock and Chuck Wrench holder makes it impossible to start the machine without removing the chuck wrench. This protects both workmen from injury and machine from damage. A highly important Safety Feature.
2. The new Eccentric Spool Pipe Centering Device is detached from the rotating spindle—prevents the whip of long revolving lengths of pipe from rocking the spindle and causing flat-sided, leaky threads.

And don't forget—there are 192 different kinds and sizes of dies available, in stock, for your every requirement when you buy a Beaver Model-A. This die inventory represents an investment of more than $150,000—to insure immediate user service. Sold by leading jobbers—

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IS your plant consuming power that goes to waste? Power loss through inefficient distribution and obsolete electrical layout results in high power costs *plus* abnormal deterioration of your entire electrical system. Let us show you how power waste and subsequent high costs can be eliminated by *power factor correction*—a Hyre Electric specialty.

- Specialists in engineering and construction on all types of industrial and commercial power and lighting.
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oils, lubricating oils, hydraulic oils, and similar fluids. Capacities are listed from 0.5 to 1000 gpm at 500 psi and 150 gpm at 1500 psi. DeLaval Steam Turbine Company.

Two-Stage Pump (LL) Specifications and features are presented in a four-page bulletin for a two stage centrifugal pump. A cross-sectional drawing (with each part identified) illustrates how hydraulic balance is maintained. Outline dimensions and rating tables are included for 5 sizes of this model. Warren Steam Pump Co., Inc.

Mechanical Seals (MM) New 12-page illustrated bulletin describes three types of mechanical seals for centrifugal pumps. Cut away drawings of stuffing boxes in centrifugal pumps are shown, and descriptive information explains the basic operating principles. Included also are several maintenance hints on the care of seals. Byron Jackson Co., Pump Division.

Centrifugal Pumps (NN) Centrifugal pumping equipment employed in the chemical process industries is described and illustrated in a new bulletin. Complete information on a mechanical seal—specially designed to prevent leakage of corrosive liquids—and on a corrosion resistant metal is offered. Worthington Pump and Machinery Corp.

TOOLS AND SPECIALTIES

Metallizing (OO) Recent issues of the Metco News report that restoring fits by rebuilding metal parts has proved to be a great money and time

ERNST WATER COLUMNS & LIQUID LEVEL GAGES

For Every Application

Split-Gland Water Gages
Mica Shields and Gaskets
Gage Glass Illuminators
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Ernst Water Column & Gage Co.
LIVINGSTON, N. J.

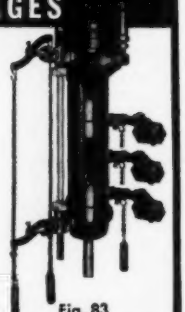

Fig. 83

COMBUSTION ENGINEERING

for power plant men . . . Become a trained combustion Engineer the easy HAYS way. Firemen, engineers, fuel and equipment men, etc., can earn bigger pay by becoming a Hays trained combustion engineer. Many employers recognize a HAYS-TRAINED engineer as a better man. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

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KEY Company

saver. Actual case histories are given for several types of applications such as axle shafts, brake drums, cylinder liners, gland sections, plungers, and lathe beds. Metallizing Engineering Co., Inc.

Portable Power Unit (PP) Just released bulletin contains information on the four features listed for this company's portable power unit. Various case histories bring out the fact that the unit can be employed for such operations as pipe threading, pipe cutting, and windlass for pulling cable. Price list for several kits is included. Beaver Pipe Tools, Inc.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

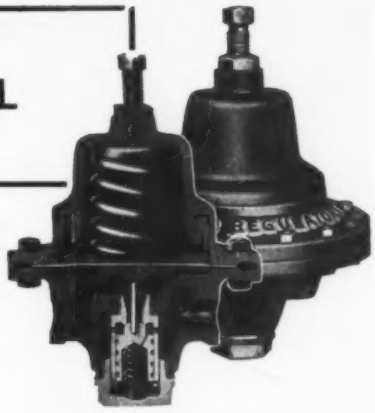
VALVES, PIPING, AND FITTINGS

Valve Specialties (QQ) Newly printed general binder contains many bulletins that cover pressure, flow, and liquid level controls for steam, gas, air, water, oil, and other fluids. Price list, dimension data, and specifications are shown for each type of valve for both light and heavy duty service. Davis Regulator Company.

Plug Valve (RR) Eccentric principle of this company's plug valve is illustrated and explained in a new bulletin. The description also includes a list of performance features. Of particular importance is a two page service recommendation table which contains sug-

Trouble-Free
PRESSURE CONTROL
for Small Units

DAVIS No. 13
Pressure Regulator



THIS pressure regulating valve is recommended for use where a restricted flow of steam, air or gas is required at reduced pressure. Single-seat valve is tight-closing, non-sticking — maintains pressure reduction automatically, regardless of circulation. All internal parts can be removed and inspected without disturbing connected piping. For full details on No. 13 and other Davis pressure regulators, write for a copy of Davis Bulletin No. 100-A.

- For Steam, Air, or Gas.
- Compact; self-contained. Built-in strainer.
- Economical to use.
- Initial pressures to 250 p.s.i.
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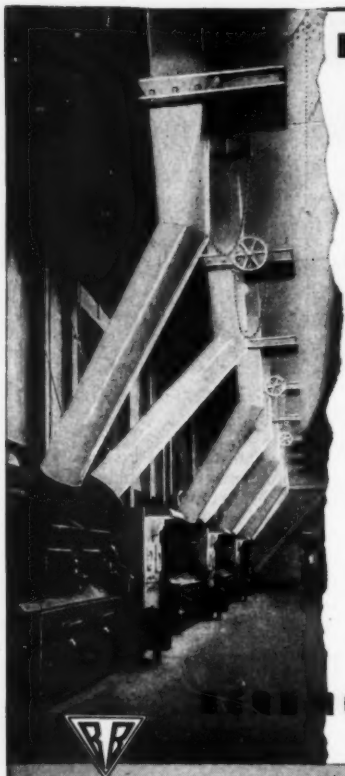

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...and INSTALL BEAUMONT ANTI-FRICTION GATES

● Many utilities are replacing their present gates with Beaumont improved anti-friction type gates. Since the first order from one utility in 1942, many repeat orders have been received for installation in this company's other power plants.

In all cases, these gates have given very satisfactory service. According to one user, "No trouble whatever has been experienced opening and closing these gates—and no maintenance has been necessary other than periodic greasing".

Many leading plants throughout the country are finding it economical and time-saving to install Beaumont trouble-free type gates such as those pictured at left. Follow the leaders and do the same. These gates are made in sizes from 14" to 30". Request complete information.

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gested metals for numerous acids and alkalis. DeZurik Shower Co.

Bronze Valves (SS) Design features of bronze globe and gate valves are discussed in a colorful four page bulletin. Diaphragm construction details are shown along with complete over-all dimensions. Valves range in size from ¼ in. to 2 in. and can be operated at pressures up to 150 psi. Manning, Maxwell & Moore, Inc.

Disc Valves (TT) Quick-operating valves for blow-off, general service, fire protection, chemical process, soot blower, and water column blowdown are described and illustrated in a 14 page bulletin. Design and construction features are shown in detail along with complete tables of dimensions, weights, and list prices. Everlasting Valve Co.

Strainers (UU) Revised four page bulletin offers data and information on screw and flange type strainers from ¼ to 3 in. pipe size. Sectional views are shown, and each of the features is thoroughly explained. Complete dimensions, weights, and price lists along with typical suggestions for installing are included. Yarnall-Waring Co.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

HEATING, VENTILATING AND AIR CONDITIONING

Humidity Control (VV) Recently published pamphlet illustrates and dis-

THIS FAMOUS TRICO COMBINATION

BOOSTS PRODUCTION

TRICO "Kliplok" Clamps afford tremendous savings by eliminating unnecessary shutdowns, damage to electrical equipment, loss of production.

TRICO "powder-packed" Renewable Fuses provide tamper-proof protection . . . are unconditionally guaranteed to give complete satisfaction.

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"KLIPLOK" CLAMPS Reduce:
- Premature fuse blowings
- Wasted kilowatts
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Write or phone for Inspection and Recommendation by a Consolidated Engineer.

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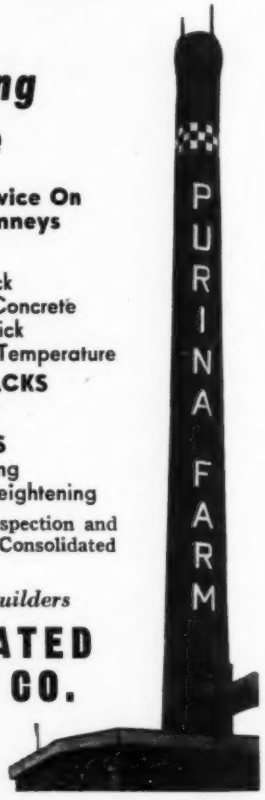

cusses a controlled humidity method to obtain dry air without mechanical refrigeration. A four color diagram shows the step-by-step process in which the air is dehumidified by absorption. Niagara Blower Company.

Year-'Round Ventilation (WW) Problems involved in supplying clean fresh air both in winter as well as in summer, are discussed in a six page folder. Photographs show several air handling units installed in a variety of plants. Typical adaptations of the units are also shown. Dravo Corporation.

Heat Loss Data (XX) Just published bulletin provides data tables for computing heat loss, figuring heat requirements, and determining fuel consumption. In addition to tables on outdoor design temperatures, the bulletin contains information on common types of industrial construction, heat losses through windows, door infiltration, heating constants, and a complete description of self-contained direct-fired industrial heating units. Thermobloc Division, Prat-Daniel Corp.

Unit Dust Collector (YY) Discussions and illustrations of a packaged air filter are supplied in a four page folder. The features of the unit are described in detail along with the advantages of minimum space and maintenance requirements. Three sizes range in capacities from 450 to 1800 cfm. The Kirk and Blum Mfg. Co.

Dust Collectors (ZZ) Problems of nuisance dust and recovery of usable powdered materials in rubber manufacturing operations are taken up in a new four page bulletin. The solution —hooding and piping arrangements trap the dust at the source and prevent disbursement to working area— is explained in detail. Photographs and drawings explain how these results are obtained. American Wheelabrator and Equipment Corporation.

Blowers and Exhausters (AAA) Recently published bulletin contains complete information on two types of electric blowers and exhauster for furnaces, cupolas, gas boosters, or when pressures up to 2 lb must be overcome. Characteristic curve, capacity, selection, and outline dimensions are included. Buffalo Forge Company.

MISCELLANEOUS

Bearing Babbitt (BBB) Complete information on heavy duty babbitt for bearings in Diesel engines and compressors is contained in a recently released leaflet. Physical characteristics show the Brinell hardness is 29.6 at room temperature and 15.1 at 212° F with a yield point of 9510 psi. Pouring range is between 925° to 1000° F. Magnolia Metal Company.

Seating Posture (CCC) Advantages of correct seating posture, from the standpoint of good health and increased working efficiency, are explained in colorful, recent bulletin. Full information is supplied on a line of aluminum posture chairs that can be adjusted five ways to conform to any physical proportions. Each type of chair is fully illustrated. Remington Rand, Inc.

Floor Covering (DDD) Folder contains concise information on how to

As one of the leading soap manufacturers on the Pacific Coast, the Pacific Soap Company has always believed that "the best equipment pays more" in results and service. That's why they asked Peabody to design a unit that would permit their detergent to be produced absolutely clean, undiscolored, and of a constant, high quality.

To do this, Peabody Engineers designed a 10,000,000 BTU/per hr. Direct Fired Air Heater with a specially-constructed Peabody Type "M" Burner that fires either oil or gas. It is with sincere pride that Peabody adds the name of Pacific Soap to the long list of prominent concerns using Peabody equipment.

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WHERE CAN YOU USE IT?

ROCKWELL "KWIKLEEN" HEAVY DUTY VALVE

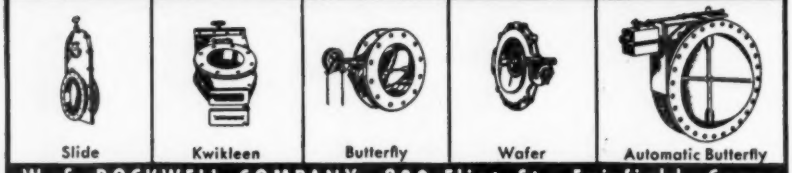
for Thick or Heavy Chemical or Petroleum Slurry Lines, Granular Solids, Paper Pulp, Dust, Scale, and Gases Containing Solid Particles

Provides full flow area and quick, tight shut-off. Valve can be cleaned without disconnecting from line by removing cover plate at bottom of sediment chamber; it can be thoroughly flushed with high pressure air, steam or water by connection to plug hole in bonnet.

Made of any metal in pipe sizes from 4" to 24", with lever handle, rising stem hand wheel, chain wheel, air cylinder or other manual or automatic controls. For pressures to 100 p.s.i.

Write for catalog on this and other Rockwell valves.

ROCKWELL VALVES FOR AIR · GAS · LIQUIDS · SOLIDS



Slide | Kwikleen | Butterfly | Wafer | Automatic Butterfly

W. S. ROCKWELL COMPANY, 230 Eliot St., Fairfield, Conn.

treat concrete floors subjected to heavy traffic. Application instructions indicate the simplicity of placing this material on the concrete floor. Test tells how the chemical closes the pores and contacts the free lime to form a hard surface. Flexrock Company.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

Insulation (EEE) New 16 page booklet describes thermal insulations for industrial and building applications. Data on thermal conductivity and sound absorption properties are included. The booklet is colorfully illustrated with numerous application photographs. Owens-Corning Fiberglas Corporation.

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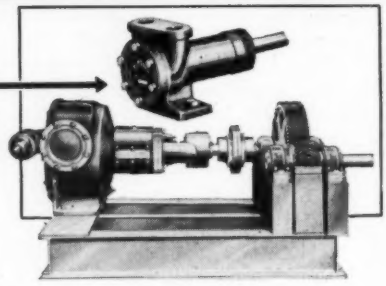
VIKING *Rotary* PUMPS

Range
FROM ½ GPM
TO 1050 GPM



If your problem is to deliver a clean liquid in any capacity from ½ to 1050 gpm, check the complete line of Viking rotary pumps. All are self-priming, non-pulsating and capable of delivering against pressures to 100 psi (200 psi in heavy-duty styles—500 psi on hydraulic oils.)

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Pumps are built to handle any liquid ranging in viscosity from L-P gas to grease. Check your requirements in bulletin 50SG. Send for your free copy today.

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Viking PUMP COMPANY
Cedar Falls, Iowa

(Advertisement)

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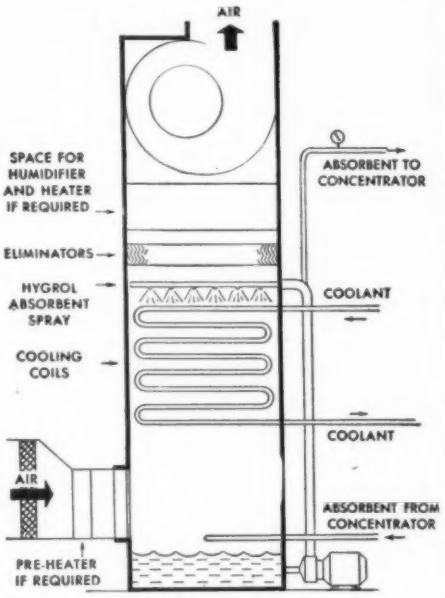
Niagara "Controlled Humidity Method" Uses Hygrol, Hygienic Liquid Absorbent

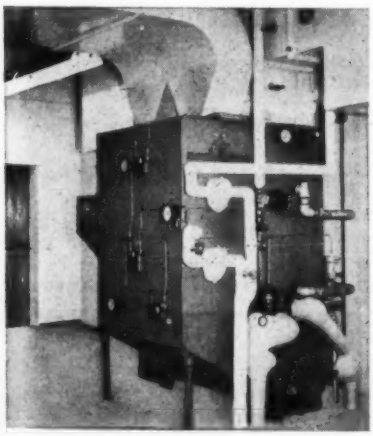
● The Niagara "Controlled Humidity Method" is a new system of air conditioning giving complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required. A condition of 15 grains of moisture per pound of air at 85 deg. F. dry bulb temperature has been produced without refrigeration.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

The apparatus is enclosed in a casing thru which the air is drawn by fans. The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.



The same equipment may be used to provide winter air conditioning when required, by installing a tempering coil at the outdoor intake, an humidifier, and a reheat coil above the eliminators.

This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit, and mutiple unit installations are practical. It is expected that, by reducing the need for refrigeration, the cost of air conditioning will be reduced by this method. Applications generally are in a temperature range from 35 deg. F. upward. Below the freezing temperature of water, the Niagara "No-Frost" method is applicable.

The equipment is protected by U. S. and foreign patents. Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

For further information, write Niagara Blower Company, Dept. IP, 405 Lexington Ave., New York 17, N. Y.

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Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
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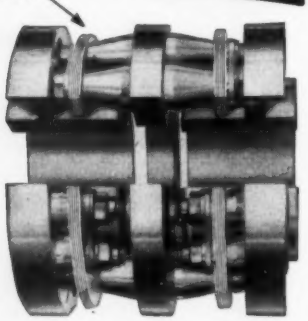

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

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WARREN, PENNSYLVANIA

READERS' GUIDE

(Continued from page 33)

the most difficult installation. The Williams Gauge Co.

160—See page 40. Gate Valves: Write for complete information on Series 9850 valves for 150-800 pounds general service. Sizes ¼" to 2" incl. Henry Vogt Machine Co.

161—See page 168. Kwikleen Valves: Kwikleens are standard equipment for control of air or gases contaminated with solid particles. Made of any metal, in any size from 4" to 24", for any type of manual or remote control. Write for Catalog on this and other Rockwell valves. W. S. Rockwell Company.

162—See page 179. Altitude Valves: These valves insure proper storage water circulation and maintain a constant water level within a variation of 3" to 12". Write for free descriptive catalog. Golden-Anderson Valve Specialty Co.

163—See page 124. Complete Line of Valves: This company manufactures a complete line of valves for controlling the flow of water, steam, gas, oil and chemicals. Consult them without obligation. The Fairbanks Company.

164—See page 49. R-S Valves: Here's a new catalog you'll want to add to your valve information file. It's Catalog No. 18 featuring R-S 50-pound valves. It will pay you to send for this carefully prepared catalog today. R-S Products Corp.

WELDING EQUIPMENT

165—See page 46. Prest-O-Lite Kit: Kit contains 4 stems and a soldering copper—complete for every air-acetylene job from the heaviest to most delicate. Weighs only 5 lb. 13 oz. with its own carrying case. Write for more details on the 5-in-1 precision outfit. The Linde Air Products Company.

WIRE ROPE

166—See page 38A. Preformed Wire Rope: With no pent-up stresses held within the rope structure this rope operates over sheaves and drums with less fatigue. Complete data on request. Wickwire Spencer Steel Div., of Colorado fuel & Iron Corp.

MISCELLANEOUS

167—See page 164. Combustion Engineering Course: Send for book, "Opportunities for the Combustion Expert." which offers a complete outline of the Hays Home Study Course. Hays School of Combustion.

168—See page 166. Chimney Engineering Service: Write for inspection and recommendation by a Consolidated Engineer. Complete service for new chimney construction and chimney repair. Consolidated Chimney Co.

169—See page 164. Electrical Engineering and Construction: Complete technical service—staff of 10 electrical engineers and designers available for consultation. Capacity to handle complete installations on all industrial and commercial light and power problems. Write today. No obligation. Hyre Electric Co.

170—See page 179. Power Plant Engineers' Guide: A complete steam engineers' library in one book—1500 pages, 65 chapters, and 1700 illustrations. Mail coupon on page 179 for a 7 day free trial offer. Audel Publishing Co.

171—See page 162. Handbook for Management: "How To Slash Bookkeeping Costs 40 to 60%" is Remington-Rand's new booklet that tells you why you should investigate the versatile Foremost accounting machine. 16 informative pages, easy to read and understand. Yours for the asking. Remington Rand, Inc.

172—See page 173. Plastic Sleeves: Topflight plastic sleeves, extruded in plain colors or in bands of colors, for marking tubing, cables, sub-assemblies, parts. Easily and quickly applied—last indefinitely. Write for full information. Topflight Tape Co.

173—See page 158. Unit Heaters: Trane unit heaters now feature a new, completely adjustable Louver Fin Diffuser for an infinite number of diffusion pattern possibilities. Write for additional information on this new easy way to control air flow. The Trane Company.

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- Albany Grease
- Pressure Greases
- Graphite Greases
- Ball & Roller Bearing Greases
- Gear Lubricants
- Rope Dressing
- Penetrating Oils
- Automotive Lubricants

METAL WORKING
- Cutting Oils
- Grinding Compounds
- Cutting Compounds
- Grinding Oils
- Soluble Oils
- Forging Compounds
- Tempering Oils
- Rust Preventives
- Quenching Oils
- Spinning Lubricants
- Die Lubricants
- Honing Compounds

ELECTRICAL DIVISION
- Albany RBR Wire Pulling Compound
- Paraffined Cheesecloth Rolls
- Stearine Candles & Flux

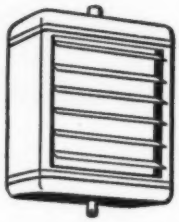
Send for Recommendation Charts

1868-1950
BUT MORE MODERN THAN EVER

ADAM COOK'S SONS, INC.
Mfrs. of Albany Lubricating Products
LINDEN, NEW JERSEY

(Advertisement)

Take Unit Heaters, for example

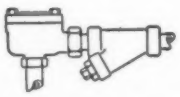


When you have steam coming into a Unit Heater with a fan blasting cold air across it, the trap must handle a tremendous volume of condensation for a short time. Webster Float-and-Thermostatic Drip Traps are ideal for this condition. The float-controlled valve stays open as long as there is water present. Stepping up the pressure results in quicker heating-up. The thermostatic element removes the air continuously – instantly.

Under-sizing the trap is like putting a hobble on the Unit Heater. Over-sizing is spending money unnecessarily. Proper size – for both capacity and pressure – gives best overall results, longer service.

The first step in picking the right trap is to pick a Webster Trap.

Webster builds a whole family of traps – each with its own pressure and capacity range . . . each designed to do a steam-saving job for you.



Traps for steam-using equipment . . . traps for heating. Whatever your trap requirements may be, you are likely to find what you need in the Webster line. See illustrations at right. Get in touch with your Webster Representative or write us direct.

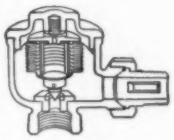
Address Dept. IP-2

WARREN WEBSTER & CO.

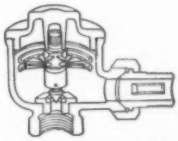
Camden, N. J. : : Representatives in Principal Cities

In Canada, Darling Brothers, Limited, Montreal

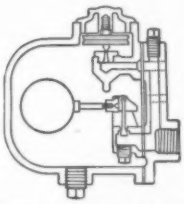
Webster HEATING



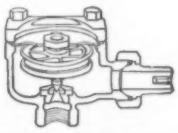
Webster Series "5" bellows-type thermostatic trap for radiators and convectors. For pressures up to 15 lbs. per sq. in. ½, ¾, 1" sizes.



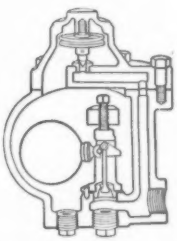
Webster Series "7" diaphragm-type thermostatic trap for radiators, drip points and steam-using equipment. For pressures up to 15 lbs. per sq. in. ½, ¾, 1" sizes.



Webster Series "26" float-and-thermostatic drip trap for drips of mains, air conditioning coils, blast radiation, unit heaters, hot water generators, fan heater coils. For pressures up to 15 lbs. per sq. in.

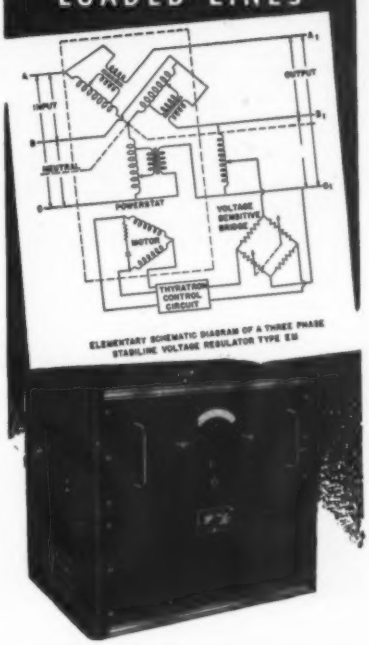


Webster Series "78" thermostatic trap. For steam-using equipment. For pressures up to 150 lbs. per sq. in. ⅜, ½, ¾, 1" sizes.



Webster Series "79" float and thermostatic trap. For drips of mains and risers, unit heaters, steam-using equipment. For pressures up to 150 lbs. per sq. in.

MAINTAIN
CONSTANT
VOLTAGE ON HEAVILY LOADED LINES



ELEMENTARY SCHEMATIC DIAGRAM OF A THREE PHASE STABILINE VOLTAGE REGULATOR TYPE EB

USE STABILINE ELECTROMECHANICAL VOLTAGE REGULATORS

In the plant — as in the laboratory — constant voltage is a necessity. It can be maintained to large industrial loads by using STABILINE (Electromechanical) Automatic Voltage Regulators.

These units feature zero waveform distortion; complete insensitivity to magnitude and power factor of load; no effect on system power factor; no critical adjustments; high efficiency; adjustable output voltage. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings; capacities to 100 KVA.

Write Today for Full Details

THE

SUPERIOR ELECTRIC

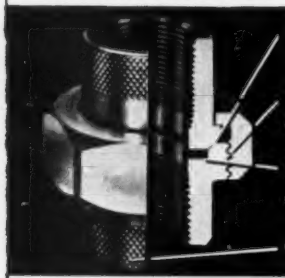
COMPANY

1502 MEADOW STREET

BRISTOL, CONN.

WECO "Junior"

The all-steel union that gives you LEAK-PROOF SEALING . . . FASTER MAKE-UP . . . GREATER STRENGTH . . . LONGER LIFE.



1 WECO BALL AND CONE SEAL. Positive, leak-proof sealing.

2 ACME THREADS . . . Rugged. Resist damage and distortion. Make-up faster.

3 RESILIENT, REPLACEABLE GASKET . . . Protects metal-to-metal seal against abrasion, corrosion.

4 KNURLED SUB ENDS. Minimize wrench slippage. Safer.

WECO "Junior" unions are made for 3000-lb. non-shock cold working pressure, in sizes ⅛" through 2". Available in machined finish, Wecolyte cadmium plated or zinc coated. Other platings on request. All parts are interchangeable.

Conveniently packaged in sturdy cartons—Sizes ⅛" through 1" packed 24 to carton; larger than 1" packed 12 to carton.

Ask your Oil Field, Industrial or Mill Supply Store for WECO "JUNIOR" UNIONS. Illustrated brochure available. Write for your copy today.

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WELL EQUIPMENT MFG. CORP.

Subsidiary of Chiksan Company

HOUSTON 1, TEXAS

Exclusive Sales Representative Outside Mid-Continent Area

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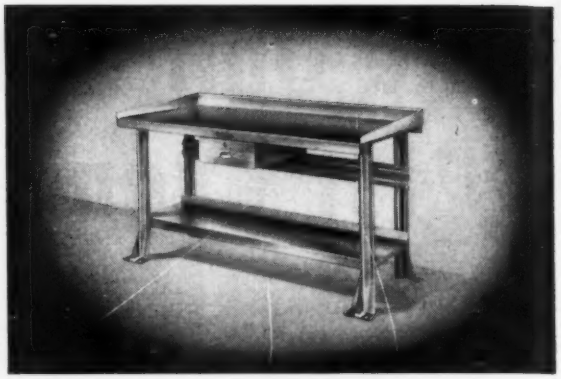
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment



The HALLOWELL WORK BENCH OF STEEL

Standardized, *ready-made* HALLOWELL Work Benches save trouble and expense of "building your own"; provide superior equipment for maximum productivity.

Interchangeable units readily adaptable to individual requirement. Easily bolted together to form continuous bench, yet may be taken down and reassembled as single units. Rigid, heavy-duty construction eliminates bolting to the floor, minimizes installation and maintenance.

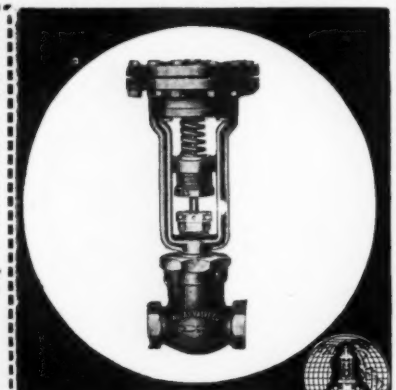
HALLOWELL Work Benches do credit to any plant. Functional design and attractive appearance encourages better plant housekeeping and worker performance.

Full details in Bulletin 701.

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 39, PENNSYLVANIA

ATLAS Type "D" REDUCING VALVE



Type "D", described in Bulletin 1-A, is well liked by engineers. It is simple, gives accurate and close regulation, is easy to inspect, has removable diaphragm top, and is adaptable to steam, air, or gas. Up to 175 lb. per sq. in. pressure.

What are your regulating problems? For over a half century ATLAS has specialized in regulating valves for every service. We shall be glad to send you specific data on ATLAS products. Use the coupon at the left.

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REGULATING VALVES FOR EVERY SERVICE

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Represented in Principal Cities

Atlas Valve Co., 287 South St., Newark 5, N. J.

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Let us survey your material handling and storage problems. We will be glad to extend this service to you without obligation.

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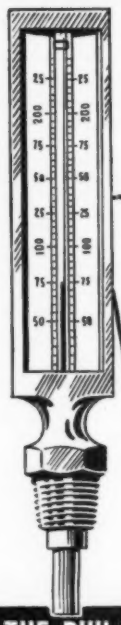

for SPECIALIZED INDUSTRIAL USE

- FOR DIESEL ENGINES AND TURBINES
- COMPRESSORS
- OIL LINES, ETC.

These thermometers made with side or oblique angle stem or with longer stem and socket.

SEND FOR CATALOG

THE PHILADELPHIA THERMOMETER CO.
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FOR MARKING TUBING, CABLES SUB-ASSEMBLIES, PARTS

Topflight plastic sleeves are extruded in plain colors or in bands of colors. All standard and Army-Navy color codes. Printed by hot-stamping method, legends can not be effaced in normal use. Sleeves are formed to proper diameters, easily snapped in place and held permanently by Topflight bonding fluid. Easily and quickly applied - last indefinitely. Write for full information, stating your needs.

ALSO TOPFLIGHT PRINTED PRESSURE-SENSITIVE TAPES — TOPFLEX AND TOPFLEX, JR.

TOPFLIGHT TAPE COMPANY
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GENERAL
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RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

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CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

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Our personnel with the experience gained through long and varied marketing activity assures effective servicing of any fuel requirement.

General Coal Company

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QUESTION:

Which Garlock rod packing is braided through and through for longer life?

ANSWER:

LATTICE-BRAID

In GARLOCK LATTICE-BRAID *every braiding strand* passes diagonally *through* the body of the packing at an angle of approximately 45°. All the strands are strongly lattice-linked together into a structural unit which holds together even when the packing is worn far beyond the limits of wear of ordinary braided packings.

LATTICE-BRAID packing is manufactured of asbestos, flax or cotton for various types of service. Write for descriptive folder.

The unique structural design of LATTICE-BRAID packing gives it great strength, long life and unusual flexibility.

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THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

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GARLOCK

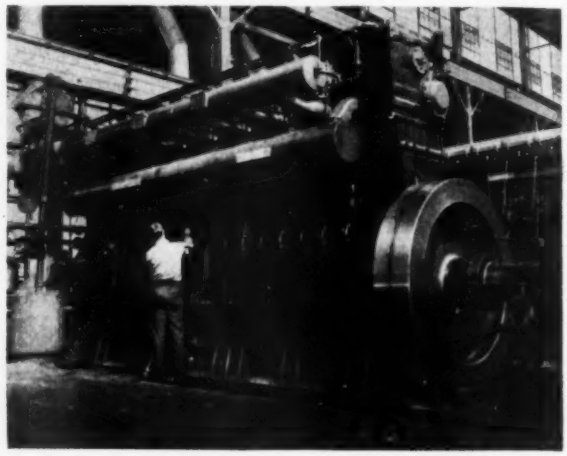
PACKINGS, GASKETS AND OIL SEALS

"SPOT" NEWS OF INDUSTRY

(Continued from page 113)

March 1950. Present plans call for parallel operation with the municipal light plant power supply and existing gas engine generators, now in operation at the Columbus Sewage Treatment Works.

One distinguishing feature of the new Diesel engine is the instant and automatic change-over from gas to fuel



oil by merely pressing a button and without any change or substitution of parts. Indicator lights show operators at a glance the kind of fuel supplied. Mixing adjustments on any combination of fuels are automatically controlled.

Fuel ratings for the new Diesel will be as follows: sewage sludge gas, 600 Btu per cu ft; natural gas, 1000 Btu per

(Continued on page 176)

HOTEL CLARIDGE

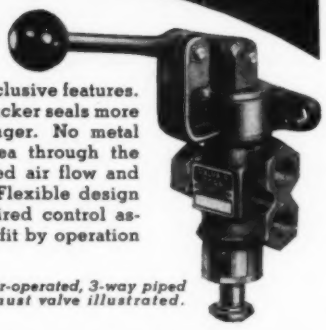
Preferred, always, by experienced travelers because of its many outstanding advantages. Conveniently located in the heart of St. Louis, only two short blocks from the Union Station and right in the center of the Wholesale District . . . Attractive rooms, each with private bath and shower and circulating ice water . . . Superior accommodations at economical rates . . . Visit our beautiful Marine Dining Room for excellent food, moderately priced.

350 ROOMS from $2.50

FREE PARKING

LOCUST AT EIGHTEENTH
ST. LOUIS MISSOURI

VALVAIR- has an Air Control Valve ... FOR EVERY AIR CONTROL NEED



Adaptability, efficiency and dependability are had with "Valvairs" because of their many exclusive features. The unique "OU" type packer seals more effectively and lasts longer. No metal seats. Standard pipe area through the valve permits unrestricted air flow and prevents pressure loss. Flexible design allows virtually any desired control assembly. Rely on and profit by operation with "Valvairs".

* * *

Lever-operated, 3-way piped exhaust valve illustrated.

The VALVAIR line includes cam-, knob-, clevis-, foot-, treadle-, cylinder-, diaphragm- and solenoid-operated air control valves.

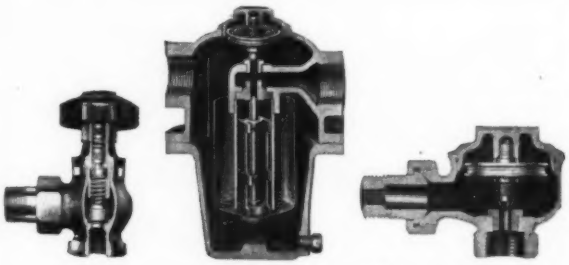
For use with air, water or oil pressures up to 175 lbs. p.s.i. and temperatures up to 120°F. 2-way; 3-way and 4-way open-end exhaust; 3-way and 4-way piped exhaust.

Sizes: ¼", ⅜", ½", ¾", 1"

Ask for Folder "A-P".

VALVAIR CORPORATION • 454 Morgan Avenue, Akron 11, Ohio
AFFILIATE: SINCLAIR-COLLINS VALVE CO.

Rely Upon Valvair — 2-WAY — 3-WAY — 4-WAY



ILLINOIS STEAM SPECIALTIES

Repair or replace worn or obsolete steam-wasting units with Illinois Specialties.

Equip your radiators with smooth-acting Illinois Supply Valves and sensitive, steam tight Illinois Thermo Traps.

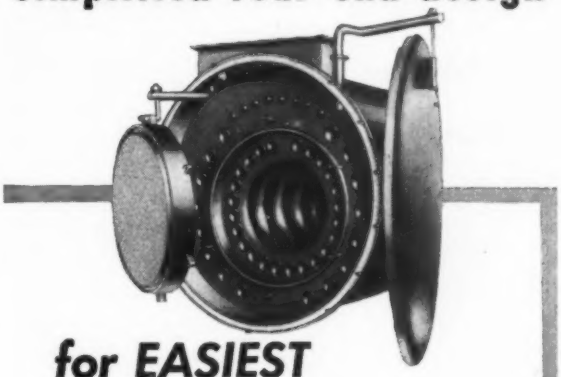
Improve system operation by replacing thermostatic drip traps with Illinois Float and Thermostatic Traps wherever rapid elimination of condensate is essential.

Illinois Float and Thermostatic Traps are made in three Series to meet a wide variety of applications and for operating ranges from 50 pounds pressure to 25 inches vacuum.

Investigate! Compare! Try Illinois Traps on your worst service and be guided by results!

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST. STREET • CHICAGO 8

AMESTEAM GENERATOR provides simplified rear end design



for EASIEST

- Inspection
- Maintenance
- Cleaning

AMESTEAM Generator design provides a better automatic Unit—soundly engineered to meet your needs.

With this simplified rear end design it is a minor operation to completely expose furnace and all tubes. Open rear flue cover—it's in one piece instead of several panels. Open rear baffle—of sturdy one-piece construction instead of numerous special refractory shapes. The baffle refractory is easy-to-get, cold-set plastic-type instead of expensive special shapes which must be ordered from the manufacturer. Flue covers and baffle are on davit-type hinges, Sizes A-50 and larger, making them easy to open in limited space.

That's only one of AMESTEAM Generator's many advantages. Auxiliary equipment is completely accessible—controls are properly positioned—all for your ease and convenience—and to save you time and money.

It all adds up to the easiest boiler to operate, inspect, maintain and clean—and it generates steam quickly, efficiently and at low cost.

Sizes 10 to 500 HP — 15 to 200 lbs. — arranged for oil, gas or oil-gas combinations.

Before you buy, learn ALL the exclusive features of the fully automatic AMESTEAM Generator. Mail coupon below for your free copy of our latest bulletin.

AMES IRON WORKS
Oswego, N. Y.
Builders of Better Boilers since 1848
Manufactured under license in Canada by VOLCANO, Ltd., Montreal, P. Q.

Choice franchises still available, write us.

Ames Iron Works, Box 902, Oswego, N. Y.

Please send me your new free bulletin of Amesteam Generators.

Name.....

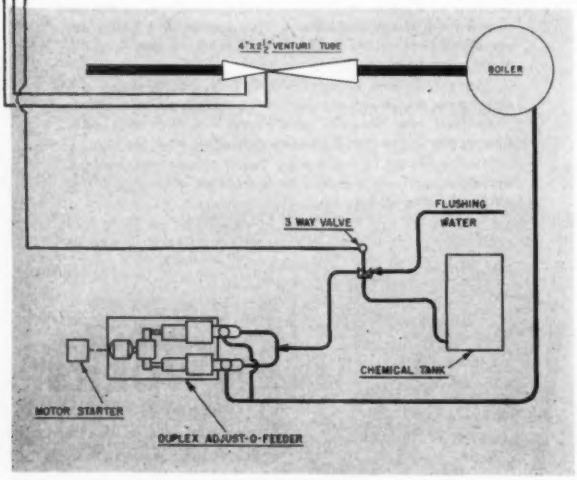
Company.....

Address.....

City..... Zone..... State.....

Records and Transmits Flow Information Paces Chemical Proportioning Pumps

Builders Chronoflo Telemeter is a double-duty system: (1) From any distance, it brings to your central control panel vital information on boiler condensate flow, and (2) it paces proportioning pumps feeding boiler water chemicals. The Chronoflo transmitter works with any differential producer — orifice, insert nozzle, or Venturi Tube. A simple 2-wire circuit is all that's needed between transmitter and receiver or pumps. The proportioning pumps feed chemical in direct proportion to flow and the system is adaptable also to "shot feeding" of boiler compounds. For Bulletins and complete information, address Builders-Providence, Inc., (Division of Builders Iron Foundry) Providence 1, Rhode Island.



Chronoflo Installation for Flow-Responsive Feeding of Chemicals Direct to Boiler Drum.

BUILDERS PRODUCTS

FLOW METERS AND CONTROLLERS . . . MECHANICAL AND DIFFERENTIAL . . . FOR LIQUIDS, STEAM, AIR, AND DRY MATERIALS THE VENTURI METER CHLORINIZERS — CHLORINE GAS FEEDERS

BUILDERS PROVIDENCE
Instruments

(Continued from page 174)

cu ft; and fuel oil, 140,000 Btu per gal. Sewage sludge gas, with a pressure of 6 to 8 in. of water at the source, will be compressed to about 20 psi. Natural gas enters the plant site at approximately 15 psi. Compressors will discharge into a gas storage tank of sufficient capacity to provide ample pulsation dampening effect.

Davis Regulator Company Celebrates 75th Anniversary

This year marks the 75th anniversary of an American pioneer and manufacturer of steam pressure reducing valves, the Davis Regulator Co. of Chicago. The business founded in 1875 by George M. Davis is now carried on successfully by his son George C. Davis, who is the present president and treasurer. Early development of the company, then known as G. M. Davis and Co., was under the personal guidance of the senior Davis, who conceived the idea of improving and manufacturing an automatic steam pressure reducing valve similar to a type employed in Germany.

Starting in a small shop located at 22 S. Canal Street in Chicago, G. M. Davis redesigned, simplified, and improved the valve that bears his name today. The original design is still embodied in one of the basic types of pressure regulators which the company still manufactures.

Development of the valve came in response to repeated demands from steam engineers for a means of utilizing steam at lower pressure (and temperature) than that provided directly from the boiler. The new pressure regulator soon became the key to maintaining comparatively low, controlled temperatures for steam heating application where low uniform pressure steam was required.

Constant contact with the developing industrial field

(Continued on page 178)

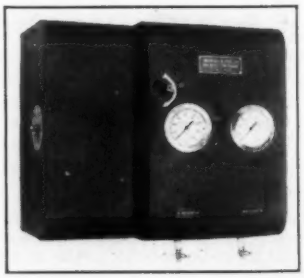
Spending too much TIME and MONEY operating your Zeolite Water Softeners or Sand Filters?

Getting erratic operation?

Then consider making them **AUTOMATIC** using the electrically operated **H & T POPPET** type multiport valves. They are "TOPS" for performance and **low in cost,** too.

Savings in labor, salt and improved operation may pay for the valves in as little as one year.

Write for details.



HUNGERFORD & TERRY, INC.
Clayton, New Jersey
Over 50 years experience—Over 5,000 installations

STEAM TO FIT YOUR JOB

START

. . . at pushbutton ease
. . . controlled to
micrometer accuracy
with *SPEEDYLECTRIC*
Electrode Steam Boiler

Just flick a switch, turn a valve—the Speedylectric Boiler is ready to go to work! Produces up to 300 lbs. of steam per hour with pressure (10-500 psi.) and temperature (up to 470°F) ***automatically controlled*** . . . no moving parts. Use on open or closed system for molding, laminating, embossing, process heating, pressing machines, sterilizers — anywhere where you need accurately controlled steam quickly, in quantity.

Speedylectric Boilers are available in standard models from 1½ to 15 BHP — larger boilers built to order. Safe all-electric construction . . . no tubes, resistance coils, flame or flues . . . 98% efficient. Write for details on model best suited to your job. Request bulletin 325-2.

10 BHP Speedylectric Boiler—big in capacity yet small in size.

LIVINGSTONE ENGINEERING COMPANY

Manufacturers of SPEEDYLECTRIC **Steam Boilers**
and Steam-Jet Cleaners

100 Grove Street **Worcester 5, Mass.**

When your concrete floors develop cracks, ruts, shallow holes or rough spots, repair them with Smooth-On No. 7B Quick Floor Patch Cement. It comes in powder form ready to mix with water. Simply apply Smooth-On No. 7B as you would plaster. Smooth-On No. 7B expands slightly as it hardens, insuring a secure, tight fit. You get an iron-hard surface that can take the punishment of heavy traffic. Order Smooth-On No. 7B Quick Floor Patch Cement in 1, 5, 20, or 100 lb. size.

FREE ***Folder and Repair Handbook***

Write for your copy of the illustrated Smooth-On Quick Patch folder and the famous Smooth-On Repair Handbook. Pocket size, 40 pages, 170 simple illustrations. Shows how to make many time-saving, money-saving repairs.

SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

SO-349

Do it with **SMOOTH-ON**
QUICK FLOOR PATCH CEMENT

This company* planned to spend $2000.00 to clean out fuel oil sludge—

HOUGHTO-SOLV saved them $1932.50!

How? Instead of a laborious, slow and costly hand cleaning of their fuel oil tanks containing 20,000 gallons of oil-sludge mixture, they poured in half a drum of HOUGHTO-SOLV, Houghton's powerful sludge solvent.

In a few short days the solvent had taken sludge into solution, saving a ten-cents-per-gallon removal cost and giving them 20,000 gallons of burnable oil. Lines and burners were clean, pumps free from clogging by sludge.

You, too, can get the same results if you'll try HOUGHTO-SOLV for slugged fuel oil systems. Write for new descriptive folder and prices.

E. F. HOUGHTON & CO.
303 W. Lehigh Ave. • Phila. 33, Pa.

*Name on request.

HOUGHTON'S
HOUGHTO-SOLV
THE FUEL OIL ADDITIVE THAT MAKES SLUDGE BURNABLE

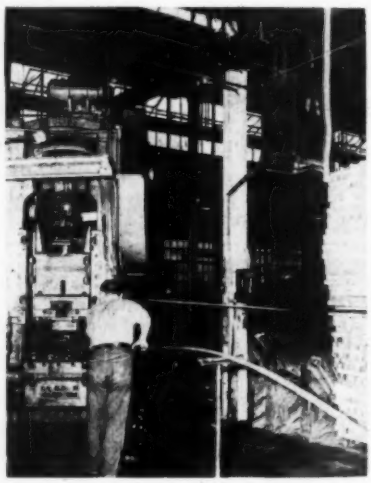
(Continued from page 176)

led to the design of numerous other pressure, flow, and control devices. The senior Mr. Davis invented several automatic pressure reducing valves and steam traps and introducing the new devices at that time was a matter of personal demonstration and sales effort. In 1885 the Davis automatic noiseless semi-balanced type back pressure valve was invented, followed shortly by the Davis combined pump governor and reducing valve for power plant accessory in 1888.

Over the years, the business enjoyed steady growth and has moved from the Canal Street, first to 100 North Clinton St. in 1885, then to 422 Milwaukee Avenue in 1900, and finally to the present address at 2541 South Washtenaw Avenue in 1930.

Capacitor installation saves $2700 in First Year

Most recent estimates on power consumption at the Empire Plow Company, Cleveland, Ohio, revealed that an annual savings of $2700 will be effected by the installation of capacitors to increase power factor. In January of 1949, a bank of four capacitors—two 90 kvar and two 30 kvar—were installed in the plant's power distributor system by the General Electric Company. The previous low power factor of 61% was increased to 97.3% in a period of a month.



Total cost of the installation, which includes capacitors, switches, and erection changes, was $1907. The Empire Plow Company engineers estimate that at the rate of $2700 saving a year, the present system paid for itself in the first seven months of operation.

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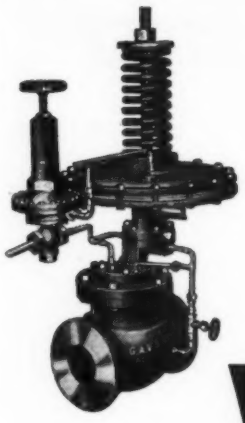

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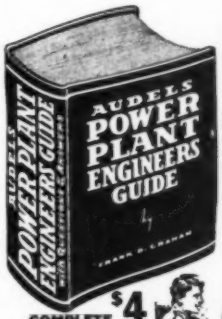

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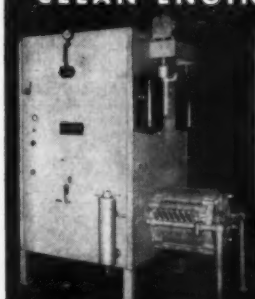

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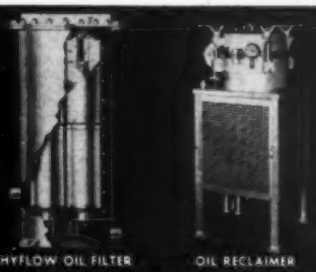

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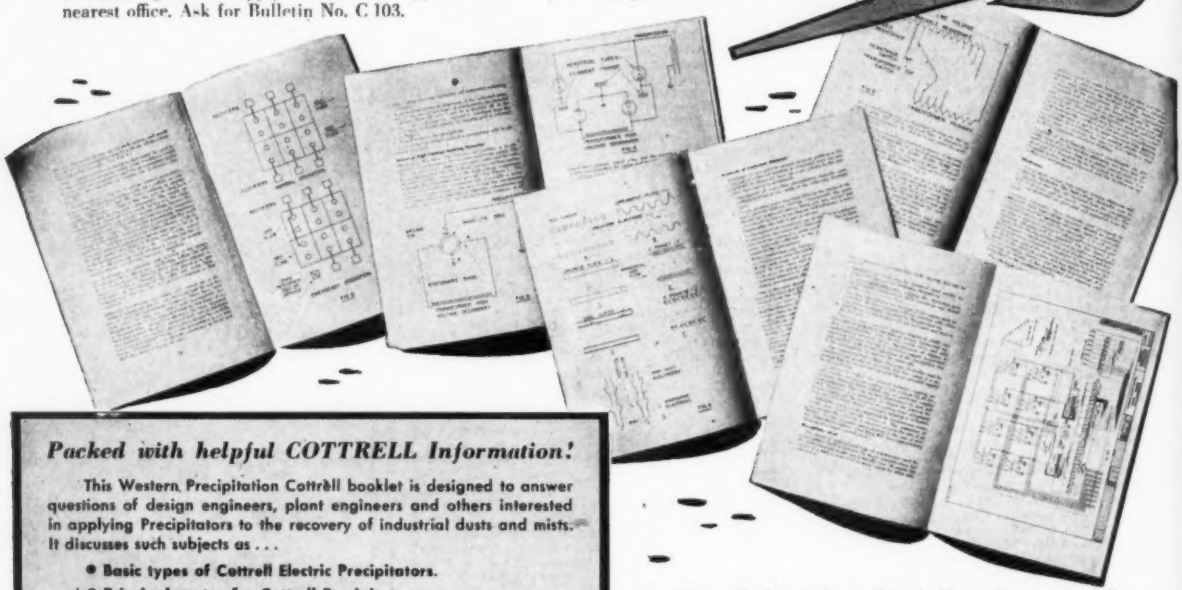

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